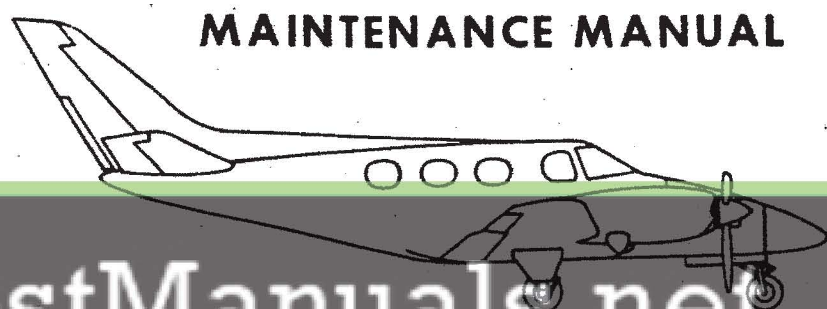
Beechcraft® DUKE

MODEL 60 (P-4 thru P-126 except P-123)
MODEL A60 (P-123, P-127 thru P-246)
MODEL B60 (P-247 and after)

MAINTENANCE MANUAL



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LIST OF EFFECTIVE REVISIONS

Always destroy superseded pages when you insert revised pages.

LOG OF REVISIONS

PART NUMBER	DATE	CHAPTER AFFECTED
60-590001-25	November 2, 1973	Original
60-590001-25A1	August 16, 1974	61, 71
60-590001-25A2	May 30, 1975	Intro, 5, 12, 21, 25, 27, 30, 32, 36, 56, 61, 71, 91, Insp.
60-590001-25A3	October 27, 1975	Intro, 7, 12, 22, 28, 30, 32, 53, 57, 91
60-590001-25A4	October 19, 1977	12, 24, 25, 28, 30, 32, 33, 61, 73, 79
60-590001-25A5	May 12, 1978	Intro, 5, 11, 12, 20, 23, 24, 30
60-590001-25A6	September 14, 1979	Intro, 5, 27
60-590001-25A7	February 22, 1980	Intro, 5, 12, 21, 57, 91
60-590001-25A8	April 18, 1980	Intro, 11, 12, 20, 25, 33, 52
60-590001-9A9	August 15, 1980	Intro, 25, 38
60-590001-25A10	November 28, 1980	5
60-590001-25A11	February 27, 1981	55, 57
60-590001-25A12	April 2, 1981	5, 57, 91
60-590001-25A13	June 21, 1982	5, 30

NOTE: A list of the effective pages will be found in the front of each chapter.

A18

98 36416C

Basic publications are assigned a part number which appears on the title page with the date of the issue. Subsequent revisions are identified by the addition of a revision code after the part number. A1 after a part number denotes the first revision to the basic publication, A2 the second, etc. Occasionally, it is necessary to completely reissue and reprint a publication for the purpose of obsoleting a previous issue and outstanding revisions thereto. As these replacement reissues are made, the code will also change to the next successive letter of the alphabet at each issue. For example, B for the first reissue, C for the second reissue, etc.

When ordering a handbook, give the basic number, and the reissue code when applicable, if a complete up-to-date publication is desired. Should only revision pages be required, give the basic number and revision code for the particular set of revision pages you desire.

LIST OF EFFECTIVE REVISIONS

Always destroy superseded pages when you insert revised pages.

60-590001-25A14	November 30, 1983	Intro, 5, 12, 20, 57, 91
60-590001-25A15	June 13, 1984	23, 32, 57
60-590001-25A16	September 20, 1985	Intro, 27
60-590001-25A17	January 9, 1986	12
60-590001-25A18	November 20, 1987	5, 25, 32

INTRODUCTION

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INTRODUCTION-EFFECTIVITY	1	Sep 20/85
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"END"

INTRODUCTION

This BEECHCRAFT Duke 60 Maintenance Manual is prepared in accordance with the ATA (Air Transport Association) Specification No. 100 format. Additional airframe manuals, which supplement this maintenance manual are the BEECHCRAFT Duke 60 Wiring Diagram Manual, P/N 60-590001-29 and the BEECHCRAFT Duke 60 Beech Manufactured Component Maintenance Manual, P/N 60-590001-27.

NOTICE

Beech Aircraft Corporation expressly reserve the right to supersede, cancel and/or declare obsolete any part, part numbers, kits or publication that may be referenced in this manual without prior notice.

NOTE

Service publication reissues or revisions are not automatically provided to the holders of this manual. For information on how to obtain a revision service applicable to this manual, refer to BEECHCRAFT Service Instructions No. 0250-010, Rev. I or subsequent revisions.

CORRESPONDENCE

If a question should arise concerning the care of your airplane, it is important to include the airplane serial number in any correspondence. The serial number appears on the model designation placard (refer to Chapter 11 for placard location).

ASSIGNMENT OF SUBJECT MATERIAL

The content of this publication is organized at four levels: Group, System/Chapter, Sub-System/Section, and Unit/Subject.

Group - Identified by different colored divider tabs. These are primary divisions of the manual that enable broad separation of content. Typical of this division is the separation between Airframe Systems and the Power Plant.

System/Chapter - The various groups are broken down into major systems such as Air Conditioning, Electrical Power, Landing Gear, etc. The systems are arranged more or less alphabetically rather than by precedence or importance. They are assigned a number, which becomes the first element of a standardized numbering system. Thus, the element "28" of the number 28-00-00 refers to the chapter "Fuel". Everything concerning the fuel system will be covered in this chapter.

Sub-System/Section - The major systems of an aircraft are broken down into sub-systems. These sub-systems are identified by the second element of a standard numbering system. The number "40" of the number 28-40-00 is for the indicating portion of the fuel system.

Unit/Subject - The individual units within a sub-system may be identified by the third element of the standard numbering system, such as 28-40-01. This number is assigned by the manufacturer and may, or may not, be used and will vary in usage.

APPLICATION

Any publication conforming to the ATA format will use the same basic numbering system. Thus, whether the manual be a BEECHCRAFT Duke 60 Maintenance Manual, or Wiring Diagram Manual for a Beech Duke 60, the person wishing information concerning the indicating portion of the fuel system would refer to the Tab System/Chapter 28, Fuel. The table of contents in the front of the chapter will provide a list of sub-systems covered in the chapter.

For example:

28-00	General
28-10	Storage (Tanks, cells, necks, caps, instruments, etc.)
28-20	Distribution (Fuel lines, pumps, valves, controls, etc.)
28-30	Dump (If in-flight dumping system is installed, it would appear here.)
28-40	Indicating (Quantity, temperature, pressure, etc., does not include engine fuel flow or pressure.)

Carrying this example further, Fuel Indication, Left Indicator Panel, could be assigned the number 28-41-01.

The table of contents in front of each chapter will list the items covered and the numbers assigned.

All publications will use the standard numbering system, even though all chapters may not be applicable to the aircraft or to the publication.

ATA 100 PAGE BLOCK GUIDE

Following is a guide to the assignment of the blocks of pages within each System/Chapter, Sub-System/Section, Unit/Subject number in the maintenance manual.

Description and Operation	Pages 1 to 100
Troubleshooting	Pages 101 to 200
Maintenance Practices	Pages 201 to 300

The text providing the coverage of the description and operation of a system or component would appear on pages numbered consecutively 1 through 100, if needed. The information pertaining to the troubleshooting of this same system or component would appear on pages numbered consecutively 101 through 200, if needed. The maintenance practices information would appear on pages numbered 201 through 300. The word "END" at the bottom of a page would indicate the last page in that block.

LIST OF EFFECTIVE REVISIONS

The Log of Effective Revisions following the title page of the manual lists the revisions currently effective for the manual.

LIST OF EFFECTIVE PAGES

The List of Effective Pages and the Table of Contents in the front of each chapter will each start with page 1 and be numbered consecutively, thereafter, as necessary.

ALPHABETICAL INDEX

An alphabetical index, as part of the introduction, is provided as an assistance in locating the desired information. The alphabetical index provides the chapter and sub-chapter in which any given information may be found. Reference to the Table of Contents in the front of the indicated chapter will provide the exact page on which the information can be found.

MICROFICHE - AEROFICHE

The General Aircraft Manufacturers Association has developed a specification for microfiche and registered the name Aerofiche for use by all GAMA Members. Consult the current issue of the Publications Price List for a enumeration of the maintenance information available i Aerofiche form for order from Beech Aircraft Corporation

ATA 100 INDEX GUIDE

The following is an ATA-100 System/Chapter, Sub System/Section Index Guide for use with Maintenanc Manuals, Parts Catalogs, Wiring Diagram Manuals an Component Maintenance Manuals as required.

WARNING

Use only genuine BEECHCRAFT or BEECHCRAFT approved parts obtained from BEECHCRAFT approved sources, in connection with the maintenance and repair of Beech airplanes.

Genuine BEECHCRAFT parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in Beech airplane applications. Parts purchased from sources other than BEECHCRAFT, even though outwardly identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Salvaged airplane parts, reworked parts obtained from non-BEECHCRAFT approved sources, or parts, components, or structural assemblies, the service history of which is unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or have other hidden damage, not discernible through routine visual or usual nondestructive testing techniques. This may render the part, component or structural assembly, even though originally manufactured by BEECHCRAFT, unsuitable and unsafe for airplane use.

BEECHCRAFT expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-BEECHCRAFT approved parts

NOTE

It shall be the responsibility of the owner/operator to ensure that the latest revision of publications referenced in this handbook are utilized during operation, servicing, and maintenance of the airplane.

ATA-100 SYSTEM/CHAPTER INDEX GUIDE

The following chapters are not covered within this Maintenance Manual: 26, 29, 31, 37, 39, 49, 54, 60, 70, 75, 76, 78, and 83

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE
INTRODUCTION		
AIRCRAFT GENERAL		
5	**TIME LIMITS/MAINTENANCE CHECKS**	
	10	Time Limits
	20	Scheduled Maintenance Checks
6	**DIMENSIONS AND AREAS**	
7	**LIFTING AND SHORING**	
	00	General
8	**LEVELING AND WEIGHING**	
	00	General
9	**TOWING AND TAXIING**	
	00	General
10	**PARKING AND MOORING**	
	00	General
11	**PLACARDS AND MARKINGS**	
	00	General
12	**SERVICING**	
	00	General
	10	Replenishing
	20	Scheduled Servicing
AIRFRAME SYSTEMS		
20	**STANDARD PRACTICES-AIRFRAME**	
	00	Standard Practices-Airframe

SYSTEM/ CHAPTER	SUB-SYSTEM/ SECTION	TITLE
30	ICE AND RAIN PROTECTION	
	00	General
	10	Airfoil
	20	Air Intakes
	30	Pitot and Static
	40	Windows and Windshields
	60	Propellers/Rotors
32	LANDING GEAR	
	00	General
	10	Main Gear and Doors
	20	Nose Gear and Doors
	30	Extension and Retraction
	40	Wheels and Brakes
	50	Steering
	60	Position and Warning
33	LIGHTS	
	00	General
	40	Exterior
34	NAVIGATION	
	10	Flight Environment Data
35	OXYGEN	
	00	General
36	PNEUMATIC	
	00	General
AIRFRAME SYSTEMS		
38	WATER/WASTE	
	30	Waste Disposal
STRUCTURES		
51	STRUCTURES	
	00	General

SUPPLEMENTARY PUBLICATIONS

The following is a list of publications providing servicing, overhaul and parts information on various components on the BEECHCRAFT Duke 60 Series airplanes which you may obtain to supplement the BEECHCRAFT Duke 60 Series Maintenance Manual. In most instances you should obtain the publications directly from the manufacturer or his distributor. Only a few, such as Beech supplementary publications, are available from Parts and Service Operations, Beech Aircraft Corporation. Those which are so available are listed in the current Publications Price List. Since a wide variety of radio components and equipment is available and because radio manufacturers normally supply parts and servicing manuals with each set, radio publications have not been included in the list. As publications on additional components become available, they will be added to the list of publications.

BEECH PUBLICATIONS

98-33857	Installation, Maintenance and Illustrated Parts Breakdown for 60-389017 Voltage Regulator.
98-36235	Installation, Maintenance and Illustrated Parts Breakdown for 60-389017-1 Voltage Regulator.
98-33702	Overhaul and Parts Breakdown for 50-921560 Engine Driven Fuel Pump.
98-37031	Inspection Procedures and Maintenance Guide for the OECO 20139 and 20051 Inverter.
98-35655	Brittain B-5 and B-7 Autopilot Operating Manual.
98-35850	Brittain B-5 and B-7 Autopilot Maintenance Manual and Illustrated Parts Breakdown.
98-34350	Operation Manual for 3-Button Flight Controller.
98-35636	Operation Manual for 4-Button Flight Controller (With Heading Selector).
98-32751	Maintenance Instructions for Goodyear Wheel, Brake and Tire Assembly.
98-34998	Maintenance Instructions for Goodrich Wheel, Brake and Tire Assembly.
98-36374	Overhaul and Cleaning Procedure for Pressurization Controllers, Outflow and Safety Valves

H-14 AUTOPILOT

130333C	Maintenance Manual.
98-30603	Maintenance Manual Supplement.
92-30103B	Overhaul Instructions for BG274B2, C1, C2 Computer.
92-30105	Overhaul Instructions for CG136A1 Heading Selector.
92-30106B	Overhaul Instructions for MG113A1, MG113A2, MG113A3, MG114A4 Actuator and SG28A1, SG28A3 Pressure Switch.
92-30107A1	Overhaul Instructions for PG51A1 Altitude Control.
92-30229	Overhaul Instructions for GG205A3, GG205A4, (GG205B4) Turn and Bank Indicator Gyro.
92-30411B	Overhaul Instructions for GG201A1, GG201B1 Vertical Gyro.
92-30412B	Overhaul Instructions for GG2021, GG202B1 Directional Gyro.

H-14 AUTOPILOT (Cont'd.)

98-32523 Overhaul Instructions for MG112A1, MG112B1 Trim Actuator.

98-32839 Overhaul Instructions for CG417B1, CG417B2 Flight Controller.

VENDOR PUBLICATIONS

ENGINE

Parts Catalog PC-120, Avco Lycoming Division, Williamsport, Pennsylvania. Overhaul Manual 60294-6, Avco Lycoming Division, Williamsport, Pennsylvania. Operator's Manual 60297-13, Avco Lycoming Division, Williamsport, Pennsylvania.

FUEL INJECTION

Operation and Service Manual, Form 15-468, Bendix Corporation, South Bend, Indiana.

PROPELLER

Overhaul Instructions 117B for Hartzell Propeller, Hartzell Propeller Inc., Piqua, Ohio.

Owners Manual 115E for Hartzell HCF3YR2/C7479-2R and Hartzell HCF3YR2F/FC7479B2R Propellers, Hartzell Propeller Inc., Piqua, Ohio.

Spinner Assembly Maintenance Instruction Guide, Issued: June 1974, Hartzell Propeller Inc., Piqua, Ohio

Maintenance Handbook for Constant Speed Hydraulic Propeller Governor Type CSSA, Number 33002, Woodward Governor Company, Rockford, Illinois.

MAGNETOS

Overhaul Instructions for Bendix S-1200 Series Magnetos, Form L-609, Scintilla Division, Bendix Aviation Corporation, Sidney, New York.

Service Parts List for Bendix S-1200 Series Magnetos, Form L-608, Scintilla Division, Bendix Aviation Corporation, Sidney, New York.

STARTING MOTOR

Overhaul Instructions, Form OE-A1, Prestolite Company, Toledo, Ohio.

DEICER DISTRIBUTOR VALVE

Overhaul Instructions with Parts Breakdown, Publication Number 38U-2-142, Fluid Power Division, Bendix Aviation Corp. Utica, New York.

Operation and Service Instructions, Publication Number 39U-1-810E Fluid Power Division, Bendix Aviation Corp. Utica, New York.

ELECTRONIC SYNCHRONIZER

Installation Manual, Bulletin Number 33032A, Woodward Governor Company, Rockford, Illinois.

Propeller Synchronizer for Light Twin Engine Aircraft, Bulletin Number 33049C, Woodward Governor Company, Rockford, Illinois.

HYDRAULIC ACCUMULATOR

Maintenance Manual Number 33058, Woodward Governor Company, Rockford, Illinois.

GENERATOR

Overhaul and Parts Breakdown, File 30204, Lear Siegler Inc., Cleveland, Ohio.

BATTERY

Operator and Service Manual for Vented-Cell Nickel-Cadmium Battery, GET3593A, General Electric Company, Gainesville, Florida.

Maintenance Manual for Nickel-Cadmium Battery, ABD1100, Gulton Industries, Inc., Metuchen, New Jersey.

Marathon Battery Installation Manua, BA89, Marathon Battery Co., Cold Springs, N.Y.

ELECTRIC PROPELLER DEICER

Installation of Deicer Boots, Report 59-728, B.F. Goodrich Company, Akron, Ohio.

Installation, Inspection and Testing of Propeller Deicer System, Report 68-04-708, B.F. Goodrich Company, Akron, Ohio.

HEATER VENT BLOWER

Overhaul Instructions for Vane Axial Blower Number M6921N6A, with Motor M3416DA, Dynamic Air Engineering Inc., Santa Ana, California.

HEATER

Maintenance Instructions for Janitrol A34D51 Aircraft Heater, Publication Number 57D83, Janitrol Aero Division, Midland-Ross Corporation, Columbus, Ohio.

Maintenance Instructions for Janitrol 52D70 Aircraft Heater Ignition Unit, Publication Number 58D42, Janitrol Aero Division, Midland-Ross Corporation, Columbus, Ohio.

AIR CONDITIONER COMPRESSOR

Series 67 Compressor Service Manual, Form 180.33NM, York Corporation, York, Pennsylvania.

Renewal Parts List, Form 180.33RP, York Corporation, York, Pennsylvania.

OUTFLOW AND SAFETY VALVE

Operation and Maintenance Instructions, Report No. 4-268, 15 April 1975, Garrett Airesearch Manufacturing Division, Los Angeles, CA.

FUEL CELLS

Recommended Handling and Storage Procedures for Bladder Type Fuel and Oil Cells, Publication Number FC1473-73, Uniroyal Inc., Mishawaka, Indiana 46544.

Repair Procedures for Heated Repairs to Bladder and Self-sealing Fuel Cells, Repair Procedure RK-72, February 3, 1977, Uniroyal, Inc., Mishawaka, Indiana 46544.

NEWMATIC AUTOPILOT

B-8 Ground and Flight Check Procedures Manual Number 3957, Brittain Industries, Torrance, California.

LANDING GEAR MOTOR

Component Maintenance Manual with Illustrated Parts List for Landing Gear Motor P/N 27-4 and 27-8, Electro-Mech, Inc., Wichita, Ks.

BRAKES

Overhaul Information for A22 Brake Shuttle Valve, Publication Number 74456, Hoof Products, Co., Chicago, Illinois.

Overhaul Information for Brake Shuttle Valve, A-SA404, Publication Number 23595, Paramount Machine Co., Stow, Ohio.

EMERGENCY LOCATOR TRANSMITTER

Operating Instructions for Model CIR-10( ) Emergency Locator Transmitter System, Transmitter P/N TR 70-17, Collins/Communications Components Corporation, Costa Mesa, California.

Operating Instructions for Model CIR-11( ) Emergency Locator Transmitter System, Transmitter P/N TR 70-13, Collins/Communication Components Corporation, Costa Mesa, California.

Owners Manual, Installation and Pilot's Guide P/N 03716-0602 for the Narco ELT 10 Emergency Locator Transmitter, Narco Avionics, Division of Narco Scientific Industries, Fort Washington, Pennsylvania.

ALPHABETICAL INDEX

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"END"

CHAPTER 5

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CHAPTER 5 - TIME LIMITS/MAINTENANCE CHECKS

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"END"

OVERHAUL AND REPLACEMENT SCHEDULE

The first overhaul or replacement must be performed not later than the recommended period. The condition of the item at the end of the first period can be used as a criterion for determining subsequent periods applicable to the individual airplane or fleet operation, provided the operator has an approved monitoring system.

The time periods for inspections noted in this manual are based on average usage and average environmental conditions.

NOTE

The recommended periods do not constitute a guarantee the item will reach the period without malfunction as the aforementioned factors cannot be controlled by the manufacturer.

SPECIAL CONDITIONS CAUTIONARY NOTICE

WARNING

Prior to performing maintenance on an engine or the Airframe, ALWAYS pull the starter control circuit breakers and the Landing Gear circuit breaker. This will kill power to the starter control as well as the igniter power relay and Landing Gear Control relay.

Airplanes operated for Air Taxi, or other than normal operation, and airplanes operated in humid tropics, or cold and damp climates, etc., may need more frequent inspections for wear, corrosion and/or lack of lubrication. In these areas, periodic inspections should be performed until the operator can set his own inspection periods based on experience.

NOTE

The date noted on the "STANDARD AIRWORTHINESS CERTIFICATE", FAA Form No. 8100-2, which is issued with each new airplane, is to be used as the basis for all TBO or replacement components listed in the following schedule.

NOTE

An engine cycle is defined as the period of time from the initial start to shutdown of the engine. This encompasses start-up, increase to full or partial power (as required during a flight regime) and back to complete engine shutdown. Normal operation results in the number of landings being equivalent to engine cycles.

OVERHAUL AND REPLACEMENT SCHEDULE

ITEM	OVERHAUL OR REPLACE

NOTE

"On Condition" items are to be overhauled or replaced when inspection or performance of these items reveal potentially unsafe or unserviceable condition.

LANDING GEAR

Main gear	Every 2000 hours

OVERHAUL AND REPLACEMENT SCHEDULE (Cont'd)

ITEM	OVERHAUL OR REPLACE
LANDING GEAR (Cont'd)	
Nose Gear	Every 2000 hours
Actuator assembly	Every 4000 hours or on condition
Retract motor	Every 2000 hours
Retract motor brushes	Every 500 hours or on condition
Shimmy damper	Every 2000 hours or 3 years
Wheels and tires	On condition
Brake assembly	On condition
Brake lining	On condition
Master cylinder	On condition
Shuttle valve assembly	On condition
Parking brake valve	On condition
All hose	On condition
POWER PLANT	
Engine	Every 1600 hours for new engines with serial numbers L-804-59 and up and remanufactured engines shipped after March 1, 1976 and remanufactured and overhauled engines which incorporate improved cylinder assemblies (as described in the latest edition of Avco Lycoming Service Bulletin No. 334); every 1200 hours for all other engines
Engine controls	On condition
Engine vibration isolator mounts	On condition
Exhaust system	On Condition

OVERHAUL AND REPLACEMENT SCHEDULE (Cont'd)

ITEM	OVERHAUL OR REPLACE
POWER PLANT (Cont'd)	
Turbocharger and waste gate	On condition
Oil cooler	On condition (replace when contaminated)
Propeller (Hartzell)	Every 2000 hours or 5 calendar years, whichever occurs first
Propeller controls	On condition
Propeller governor	every 1600 hours
Dry air pressure pump	Every 600 hours or on condition
Propeller Accumulator	Every 1600 hours
Hoses carrying flammable liquids	When condition warrants, 5 years from date of delivery, or at engine overhaul, whichever occurs first
All other hoses	On condition
FUEL SYSTEM	
Fuel cells	On condition
Nacelle fuel quantity transmitter	On condition.
Wing fuel quantity transmitter	On condition.
Fuel cell drain valve	On condition
Fuel system check valves	On condition
Fuel selector-valve	Every 1000 hours
Fuel boost pump	Every 800 hours
Float valve	On condition
Hoses carrying flammable liquids	When condition warrants, 5 years from date of delivery, or at engine overhaul, whichever occurs first
All other hoses	On condition

OVERHAUL AND REPLACEMENT SCHEDULE (Cont'd)

ITEM	OVERHAUL OR REPLACE
FUEL SYSTEM (Cont'd)	
Fuel pump, engine driven	Every 1200 hours
INSTRUMENTS	
Turn and bank indicator	On condition
Altimeter	Every 24 months per FAA directive
Directional gyro	On condition
Gyro horizon	On condtion
Dry air pressure gage	On condition
Cabin altitude control	On condition
Cabin altitude controller filter - standard	On condition
Cabin altitude controller filter - motorized	Every 100 hours
Manifold pressure gage	On condition
Airspeed indicator	On condition
Cabin differential pressure gage	On condition
Cabin altitude and pressure differential indicator	On condition
Rate-of-climb indicator	On condition
Fuel pressure gage	On condition
Fuel flow gage	On condition
Tachometer	On condition
Flap position indicator	On condition
Free air temperature indicator	On condition
Gyro instrument filter	Every 500 hours
Air pump inlet filter	On condition
All hoses	On condition

OVERHAUL AND REPLACEMENT SCHEDULE (Cont'd)

ITEM	OVERHAUL OR REPLACE
INSTRUMENTS (Cont'd)	
Air pump inline filter	300 hours
ELECTRICAL SYSTEM	
Landing gear dynamic brake relay	On condition
Battery master relay	On condition
Paralleling relay	On condition
All other relays	On condition
Voltage regulators	On condition
Heater vibrators	Replace at heater overhaul
Starter	Inspect at engine overhaul and overhaul or replace on condition
Starter relay	On condition
Generator	On condition
Battery (Emergency Locator Transmitter)	At 50% of useful life (as stated on the battery) or any time transmitter is used more than one cumulative hour or after inadvertent activation of unknown duration
UTILITY SYSTEM	
Cabin heater	Every 1000 hours or whenever pressure decay test requirements cannot be met. See appropriate manufacturer's manual
Heater igniter and plug	On condition
Heater fuel pump	On condition
Heater fuel spray nozzle	Replace at heater overhaul.

OVERHAUL AND REPLACEMENT SCHEDULE (Cont'd)

ITEM	OVERHAUL OR REPLACE
UTILITY SYSTEM (Cont'd)	
Heater fuel shut-off valve	On condition
Combustion blower	On condition
Combustion blower brushes	Every 500 hours
Vent blower	On condition
Vent blower brushes	Every 500 hours
Condenser blower	On condition
Condenser blower brushes	On condition
Oxygen regulator	Every 2000 hours or 48 months
Oxygen cylinder (3HT)	Hydrostatically test every 3 years, replace every 24 years or 4,380 refills (ICC regulation)
Oxygen cylinder (3A or 3AA)	Hydrostatically test every 5 years: no replacement duration
Differential control valve (P-4 thru P-307)	Inspect every 100 hours, replace on condition
Outflow valve (308 and after)	Perform functional test every 500 hours
Safety valve (P-4 thru P-307)	Inspect every 100 hours, replace on condition
Safety valve (P-308 and after)	Perform functional test every 500 hours
FLAPS AND FLIGHT CONTROLS	
Flight controls	On condition
Aileron tab actuator	On condition
Elevator tab actuator	On condition
Rudder tab actuator	On condition
Rudder pedal arm	On condition or at 2000 hours

OVERHAUL AND REPLACEMENT SCHEDULE (Cont'd)

ITEM	OVERHAUL OR REPLACE
FLAPS AND FLIGHT CONTROLS (Cont'd)	
Flap motor and drives	Every 2000 hours
Flap gearbox	Every 2000 hours
Flap actuators	Every 2000 hours
Flap flexible shaft	Every 2000 hours
MISCELLANEOUS	
Wing bolts	Replace 10 years after the initial inspection. or on condition. See Chapter 57-00-00

"END"

SCHEDULED MAINTENANCE CHECKS - MAINTENANCE PRACTICES

NOTE

For a listing of alternative inspection programs available for use with this airplane, refer to the latest issue of the BEECHCRAFT Publications Price List (P/N 118556).

The time periods for the inspections noted in this schedule are based on normal usage under average environmental conditions. Airplanes operated in humid tropics, or in cold, damp climates, etc., may need more frequent inspections for wear, corrosion, lubrication, and/or lack of maintenance. Under these adverse conditions, perform periodic inspections in compliance with this guide at more frequent intervals until the owner or operator can set his own inspection periods based on the contingencies of field experience. Airplanes operated less than 100 hours a year must have a 100-Hour Inspection performed no later than 12 months following the date of the preceding 100-Hour Inspection. The 100-hour interval between performance of the procedures specified herein should NEVER be exceeded by more than 10 hours, which can be used only if the additional time is required to reach a place where the inspection can be satisfactorily accomplished. However, any extension of a 100-hour interval must be subtracted from the following 100-hour interval, with no time extension permitted. For example, if an inspection is done at 110 hours, the next inspection is due 90 hours later with no extension allowed.

NOTE

Ascertain that all placards are in place and legible whenever the airplane has been repainted or touched up after repairs. Replace any placards that have been inadvertently defaced or removed.

NOTE

Beech Aircraft's Recommended Inspection Program in accordance with FAR Parts 43 and 91 consists of, but is not limited to, inspection items listed in this Inspection Guide, any applicable Airworthiness Directives issued against the airframe or any equipment installed therein, conformity to Type Certificate Data Sheet and Maintenance Manual Airworthiness Limitations Chapter (Chapter 4) as applicable.

The owner or operator is primarily responsible for maintaining the airplane in an airworthy condition, including compliance with all applicable Airworthiness Directives as specified in Part 39 of the Federal Aviation Regulations. It is further the responsibility of the owner or operator to ensure that the airplane is inspected in conformity with the requirements of Parts 43 and 91 of the Federal Aviation Regulations. Beech Aircraft Corporation has prepared this inspection guide to assist the owner or operator in meeting the foregoing responsibilities. This inspection guide is not intended to be all-inclusive, for no such guide can replace the good judgment of a certified airframe and power plant mechanic in the performance of his duties. As the one primarily responsible for the airworthiness of the airplane, the owner or operator should select only qualified personnel to maintain the airplane.

While this guide may be used as an outline, detailed information of the many systems and components in the airplane will be found in the various sections/chapters of the shop/maintenance manual and the pertinent vendor publications. It is also recommended that reference be made to the applicable Maintenance Handbooks, previously issued Service Instructions, Beechcraft Service Bulletins, applicable FAA Regulations and Publications, Vendors Bulletins and Specifications for torque values, clearances, settings, tolerances, and other requirements. It is the responsibility of the owner or operator to ensure that the airframe and power plant mechanic inspecting the airplane has access to the previously noted documents as well as to this inspection guide.

Beech Aircraft Corporation issues service information for the benefit of owners and operators in the form of two classes of Service Bulletins. MANDATORY (Red Border) Service Bulletins are changes, inspections or modifications that could affect safety. The factory considers compliance with these Service Bulletins mandatory. OPTIONAL (No Border) Service Bulletins cover changes, modifications, improvements or inspections which may benefit the owner. Due to the wide range of information covered by the OPTIONAL Service Bulletin, each owner or operator is responsible for conducting a thorough review of each Optional Service Bulletin to determine if compliance is required based on the applicability of the OPTIONAL Service Bulletin to his particular set o operating conditions.

In the final analysis it is the responsi bility of the owner or operator to ensur that all previously issued Class I and I Service Instructions and Beechcraft Ser vice Bulletins which are pertinent to hi particular operation are complied with.

NOTE

In addition to the inspections prescribed by this schedule, the altimeter instrument and static system and all ATC transponders MUST be tested and inspected at 24-month intervals in compliance with the requirements specified in FAR Part 91.

100-HOUR INSPECTION

A. OPERATIONAL INSPECTION	MECH		INSP
	L	R	
1. STARTERS - Check for proper operation, unusual noises and dragging. Check starter energized light (if installed) and/or loadmeter to ensure starter disengagement when the starter switch is released.			
2. CYLINDER HEAD TEMPERATURE - Check for proper operation, temperature and fluctuations.			
3. ALTERNATOR - Check the output.			
4. PROPELLER OPERATION - Cycle propeller and check for proper rpm drop and smoothness of operation.			
5. PROPELLER SYNCHRONIZER - Check for proper operation.			
6. PROPELLER DEICER - Check for proper operation and amperage drawn on ammeter.			

A. OPERATIONAL INSPECTION (Cont'd)	MECH		INSP
	L	R	
7. OIL PRESSURE AND TEMPERATURE - Check for proper pressure, temperature limits and unusual fluctuations.			
8. MAGNETOS - Check the performance of the magneto by performing the MAGNETO DROP-OFF CHECK specified in the applicable Pilot's Operating Handbook.			
9. POWER CHECK - Check as outlined in the applicable Pilot's Operating Handbook.			
10. ALL ENGINE CONTROLS - With the engine running, check for proper operational limits, engine response and rigging. Check friction locks for proper operation. Check for proper lubrication of the connection bolts and excessive free play.			
11. PROPELLER GOVERNORS - Check for proper governor operation and feathering.			
12. AIR CONDITIONER - Operate the air conditioner and verify that the air scoop moves to the ground position when turned on and returns to the retracted position when turned off. Check for proper operation and unusual noise.			
13. FLIGHT INSTRUMENTS - Check for condition and proper operation. Check gages for proper reading.			
14. GYRO INSTRUMENTS - Check for erratic or noisy operation.			
15. DEICER (Surface) - Check for proper operation and cycling.			

A. OPERATIONAL INSPECTION (Cont'd)	MECH		INSP
	L	R	
16. IDLE RPM AND MIXTURE SETTINGS - Check for both proper rpm and mixture settings. Check controls for freedom of operation.			
17. IGNITION SWITCH - Rotate the ignition switch through the OFF position to the extreme limit of switch travel; if the engine stops firing, the switch is normal. If the engine continues to run with the switch held in the past OFF position, it is an indication that one magneto is still "hot" or ungrounded. When the switch is released from the past OFF position, it should automatically return to normal OFF and the engine should stop running. However, any ignition switch exhibiting this abnormal condition should be replaced.			
18. HEATING AND VENTILATING SYSTEM - Check for proper operation, heat and airflow output. Check controls for freedom of operation.			
19. PRESSURIZATION SYSTEM - Check for proper operation.			
20. FUEL QUANTITY AND FUEL FLOW GAGES - Check for proper operation and unusual fluctuations.			
21. FUEL BOOST PUMPS - Check for proper operation.			
22. FUEL TANK SELECTOR - Check for proper operation and feel for positive detent and proper placarding.			
23. ALL LIGHTS - Check for condition, attachment, cracked or broken lenses. Check switches, knobs and circuit breakers for looseness and operation.			
24. STALL WARNING SYSTEM - Check for proper operation.			

A. OPERATIONAL INSPECTION (Cont'd)	MECH		INSP
	L	R	
25. RADIO OPERATION - Check for proper operation, security of switches and knobs.			
26. FLAPS - Check for noisy operation, full travel and proper indication.			
27. PITOT HEAT - Check for proper heating of the unit.			
28. BRAKES - Check for condition and wear, ease of operation and proper release of the parking brake. Check for unusual brake chatter.			
29. EMERGENCY LOCATOR TRANSMITTER - Check for proper operation. Tune radio to 121.5 MHz on VHF or 243 MHz on UHF, then turn ELT switch to ON and monitor for one signal. Turn ELT switch OFF, then place in ARM position.			
30. OXYGEN SYSTEM - Functionally check the oxygen system for proper operation. Check the oxygen bottle shutoff valve for proper operation.			
31. SWITCHES, CIRCUIT BREAKERS - Check for proper operation.			
32. FLIGHT CONTROLS, TRIM CONTROLS AND TRIM INDICATOR - Check freedom of movement and proper operation through full travel with and without flaps extended. Check electric trim controls for operation.			
33. IDLE CUT-OFF - Check for proper operation and freedom of movement.			

B. POWER PLANT	MECH		INSP
	L	R	
NOTE After the first 25 hours of engine operating time, a new, remanufactured, or newly overhauled engine should be given a 100-hour inspection including draining and renewing of oil.			
1. COWLING - Check for condition and security. Remove the upper and lower cowling and clean. Inspect for cracks.			
2. COWL FLAPS - Check for travel, deformation and security. Inspect for cracks.			
3. SPARK PLUGS - Clean, inspect, regap, test and replace as necessary. Tighten spark plugs to proper torque and check ignition harness condition and for proper attachment.			
4. COMPRESSION - Perform differential compression test.			
5. PLUMBING - Inspect plumbing and associated accessories for condition (such as cracks) and attachment. Check plumbing clearance and secure against possible chafing.			
6. ENGINE OIL SUMP - Check for cracks, leaks, deformation and security.			
7. OIL DIPSTICK - Check the dipstick for rust and general condition. Inspect the dipstick tabs for security and that the tabs are not bent.			
8. OIL SUMP DRAINS AND FILTERS - Check for metal particles on filters. Check for proper torque after installation. Check drain plugs for leaks.			

B. POWER PLANT (Cont'd)	MECH		INSP
	L	R	
NOTE Change oil and oil filter per Lycoming TIO-541 Series Operating Manual.			
9. OIL COOLER - Check oil cooler, lines and fittings for condition, security, chafing and leaks.			
10. PROPELLER AND MOUNTING BOLTS - Check for condition and security. Check the tip of the blades for evidence of lightning strikes. If there is evidence of lightning strikes, consult the propeller manufacturer, the engine manufacturer and Beech Aircraft Corporation. Inspect the blades for cracks, dents, nicks, scratches, erosion, corrosion, security and movement in the hub.			
11. PROPELLER SPINNER - Check for deformation, security and cracks.			
12. PROPELLER HUB - Check for cracks, excessively leaking seals and condition. Check propeller dome pressure.			
13. PROPELLER ACCUMULATOR - Check for proper operation.			
14. STARTER - Check for condition, attachment and chafed or loose wires.			
15. MAGNETOS - Check contact points for proper clearance. Points with deep pits or excessively burned areas must be discarded. Inspect the cam follower felt pad for proper lubrication and clean the compartment with a clean, dry cloth. Check timing.			
16. IGNITION HARNESS - Inspect for fraying and attachment.			

B. POWER PLANT (Cont'd)	MECH		INSP
	L	R	
17. CYLINDERS AND BAFFLES - Check cylinders and exhaust manifold for obvious leaks, security and cracks; check baffles for cracks and security. Check cylinders for broken cooling fins and loose or missing base nuts. NOTE Accomplish valve inspection every 400 hours of operation per Lycoming T10-541 Series Operating Manual.			
18. EXHAUST SYSTEM - Check for deformation, security, cracks, leaks, loose or missing nuts and clamps. Check for thin wall condition which may occur due to normal internal erosion on stacks which have long service time.			
19. FIREWALL - Check for wrinkles, damage or cracks. Check all electrical and control access holes for proper sealing.			
20. HOSE AND DUCTS - Check all fuel, oil and air hose or duct for leakage, cracks, deterioration and damage. Check fittings for security.			
21. ENGINE ACCESSORIES - Check for condition, security and leaks. Check wiring, hoses and tubes for chafing, security and leaks.			
22. GENERATOR - Check for condition, attachment and chafed or loose wires.			
23. ENGINE MOUNTS - Check for cracks, corrosion and security. Inspect rubber cushions, mount bolts and nuts, and grounding straps for condition and security.			
24. PROPELLER GOVERNOR - Check for leaks and control arm for security.			

B. POWER PLANT (Cont'd)	MECH		INSP
	L	R	
25. ENGINE CONTROLS - Check controls and associated equipment for condition, attachment, alignment and rigging. Each 300 hours remove the throttle cable connection bolts and check for wear.			
26. ELECTRICAL WIRING AND EQUIPMENT - Inspect electrical wiring and associated equipment and accessories for fraying and attachment.			
27. AIR CONDITIONER COMPRESSOR - Check for security and attachment. Check refrigerant and oil levels. Check belt for tension and worn or frayed condition.			
28. INDUCTION AIR FILTER - Check for condition, cleanliness and security.			
29. INDUCTION SYSTEM AND ALTERNATE AIR - Check flexible air ducts for delamination of the inner lining. Check the alternate air valve for blockage, security, cracks, operation and wear.			
30. FUEL INJECTION CONTROL VALVE - Clean the screen and check for damage. Install screen and check for leaks.			
31. FUEL INJECTION SYSTEM - Inspect all fuel injection components, lines and fittings for evidence of fuel leaks, fraying and cracking.			
32. TURBOCHARGERS - Check the compressor wheel for nicks and cracks. Check linkages for security and proper operation.			
33. TURBINE INLET TEMPERATURE INDICATOR - Check the indicator for accuracy and calibrate as outlined under the heading TIT INDICATOR CALIBRATION in Chapter 77-00-00.			

B. POWER PLANT (Cont'd)	MECH		INSP
	L	R	
34. ELECTRIC PROPELLER DEICER - Check for service damage to the deicer heaters, brush rods, springs and brushes. Check the lead strap and all other clamps, connectors and wiring for electrical soundness. Check the slip rings for roughness, cracks, burned or discolored areas and for deposits of oil, grease or dirt. Check for security and attachment of all components. Check deicer boots for wrinkles, loose or torn areas.			

C. NACELLES	MECH		INSP
	L	R	
1. NACELLE SKIN - Check for deformation and obvious damage or cracks. Check for loose or missing rivets.			
2. NACELLE STRUCTURE - Check for cracks and deformation. Check for loose or missing rivets and concealed damage.			
3. PNEUMATIC PRESSURE REGULATORS - Check for condition, security and attachment.			
4. INLINE FILTERS - Clean or replace, as required, the filter in each nacelle as outlined under the heading SERVICING in Chapter 36-00-00.			
5. BATTERY - Inspect for clean, tight connections and correct fluid level. Add distilled water as required. Inspect the vent hose at the battery box for obstructions. The battery box should be washed out thoroughly and dried each time the battery is removed and cleaned.			
6. FUEL QUANTITY TRANSMITTER - Check for attachment and electrical connection.			

C. NACELLES (Cont'd)	MECH		INSP
	L	R	
7. FUEL CELLS AND VENTS - Inspect fuel cells for leakage and vent lines for security as outlined in Chapter 28-10-00.			
8. PLUMBING - Check for leakage, chafing, condition and security.			
9. ELECTRICAL WIRING AND EQUIPMENT - Inspect for chafing, damage, security and attachment.			
10. AIR CONDITIONING - Check for condition, security and attachment.			

D. WINGS AND CARRY-THROUGH STRUCTURE	MECH		INSP
	L	R	
1. SKIN - Check for deformation and obvious damage. Check for cracks, loose or missing rivets. If damage is found, check adjacent structure. Check for indications of hard landing or excessive flight loading.			
2. STRUCTURE - Check for cracks, deformation and concealed damage. Check for loose or missing rivets.			
3. ACCESS DOORS AND PANELS - Inspect for cracks, proper fit and attachment.			
4. CABLES, PULLEYS AND TURNBUCKLES - Check the wing flight control components, cables and pulleys. Replace control system components (push rods, turnbuckles, end fittings, castings, etc.) that have bulges, splits, bends, or cracks. Check control cables, pulleys, and associated equipment for condition, attachment, alignment, clearance, and proper operation. Replace cables that have broken strands or evidence of corrosion. Check cables for proper tension at the first inspection and every 100-hours thereafter.			

D. WINGS AND CARRY-THROUGH STRUCTURE (Cont'd)	MECH		INSP
	L	R	
5. AILERONS - Check for condition and security. Check for cracks, loose or missing rivets and freedom of movement. Check hinge bearings and brackets for condition, push-pull rods for security and rod ends for corrosion.			
6. AILERON TRIM TAB - Check for attachment and freedom of movement. Check free play as outlined under the heading CHECKING AILERON TAB FREE PLAY IN Chapter 27-00-00.			
7. FUEL CELLS AND VENTS - Inspect fuel cells for leakage and vent lines for security as outlined in Chapter 28-10-00.			
8. PLUMBING - Check for leakage, chafing, condition and security.			
9. ELECTRICAL WIRING AND EQUIPMENT - Inspect for chafing, damage, security and attachment.			
10. FLAP LIMIT SWITCHES - Check for condition, security and freedom of operation.			
11. FLAPS AND ACTUATORS - Check for condition, security, binding or chafing of actuator cables. Check flap skin and structure for cracks, loose or missing rivets. Check roller bearings and tracks for condition. Check stop area for condition and damage.			
12. FLAP POSITION TRANSMITTER - Check for security and operation.			
13. DRAIN HOLES - Check the drain holes in the left and right upper wing attach fittings to assure that they are open and free of obstruction.			

D. WINGS AND CARRY-THROUGH STRUCTURE (Cont'd)	MECH		INSP
	L	R	
14. WING SPAR CAP - Inspect the wing spar cap for corrosion as outlined in Chapter 57-00-00.			
15. WING BOLTS - Check wing bolts for proper torque at the first 100-hour inspection and at the first 100-hour inspection after each reinstallation of the wing attach bolts. Refer to Chapter 57-00-00 for wing bolt, nut and fitting inspection criterion and frequency.			
16. STALL WARNING VANE - Check for condition and obstructions.			
17. FUEL QUANTITY TRANSMITTER - Check for attachment and electrical connection.			
18. NAVIGATION LIGHTS - Check for cracked or broken lenses and replace bulbs as necessary.			
19. LANDING LIGHTS - Check for security and operation. Replace lens and bulbs as necessary.			
20. FUEL BOOST PUMPS AND FUEL LINES - Check for condition, security and leaks. Check lines for signs of chafing or cracks.			
21. FUEL SELECTOR VALVE - Check for security, operation and leakage.			
22. FUEL STRAINERS - Inspect and clean as outlined under the heading ENGINE FUEL FILTERS AND SCREENS in Chapter 12-10-00 of this Maintenance Manual.			

E. CABIN AND BAGGAGE COMPARTMENT	MECH	INSP
1. SKIN - Inspect skins for deformation, cracks and loose or missing rivets. If damage is found, check adjacent structure.		
2. STRUCTURE - Check for cracks and deformation. Check for loose or missing rivets and concealed damage.		
3. CABLES, PULLEYS AND PRESSURE SEALS - Check the flight control components, cables and pulleys. Replace control system components (push rods, turnbuckles, end fittings, castings, etc.) that have bulges, splits, bends, or cracks. Check control cables, pulleys, and associated equipment for condition, attachment, alignment, clearance and proper operation. Replace cables that have broken strands or evidence of corrosion. Check cables for proper tension at the first inspection and every 100-hours thereafter.		
4. PRESSURIZATION CONTROL VALVES - On airplane serials P-4 thru P-307, check the cabin pressurization safety valve and outflow valve differential adjustment every 300 hours of airplane operation or annually. On airplane serials P-308 and after,perform a functional test of the outflow and safety valves every 500 hours. On airplane serials P-308 and after, clean the cabin pressurization controller filter and orifice each 500 hours; clean the safety valve filter and orifice each 1000 hours. For checking, cleaning and testing procedures, refer to Chapter 21-30-00.		
5. FLAP MOTOR AND SHAFTS - Check for condition, security and wear at all points. Check cable housing for security and check jam nuts for tightness.		
6. BRAKE MASTER CYLINDER AND PARKING BRAKE VALVE - Check for condition, security and leaks. Check lines for signs of chafing or cracks.		

E. CABIN AND BAGGAGE COMPARTMENT (Cont'd)	MECH	INSP
7. RUDDER PEDALS - Check for freedom of movement. Check cables, push/pull rods, bell cranks, pulleys, turnbuckles, fairleads, for proper routing, condition and security. Check rudder pedal fore and aft positions for wear. Check locks and pins to ensure positive lock. NOTE On airplane serials P-555 and after, and earlier airplanes with the noted replacement rudder pedal arms, the following inspection is accomplished at 300-hour intervals.		
8. RUDDER PEDAL ARMS - Check pedal arms for cracks and replace at 2000 hours or sooner if cracks are found. Replace P/N 50-524326-7 with P/N 50-524326-17 amd P/N 50-524326-8 with P/N 50-524326-18.		
9. CONTROL COLUMN, TRIM CONTROL AND INDICATOR (Electric and Manual) - Check for freedom of movement. Inspect pulleys, sprockets, bearings, actuators, chains and turnbuckles for condition, security and operation. Check trim indicator for proper indication.		
10. ELECTRICAL WIRING AND EQUIPMENT - Check for condition, security and signs of chafing.		
11. WINDSHIELD HEATER - Check the voltge as outlined under the heading ELECTRICALLY HEATED WINDSHIELD VOLTAGE CHECK in Chapter 30-40-00.		
12. PLUMBING - Check all plumbing and connections for security, leakage and general condition.		
13. WINDOWS AND DOORS - Inspect windows for scratches, crazing and general condition. Check doors for condition and attachment. Check latching mechanism for proper engagement and ease of operation. Check that the CABIN DOOR warning light in the annunciator panel remains illuminated until the door is closed, latched and locked.		

E. CABIN AND BAGGAGE COMPARTMENT (Cont'd)	MECH	INSP
14. INSTRUMENTS AND INSTRUMENT PANEL - Inspect instrument panel, subpanels, placards and instruments for condition and attachment. Check all knobs for security. Inspect shock mounts, ground straps for cracks and security.		
15. SEATS, SEAT BELTS AND SHOULDER HARNESSES - Inspect cabin seats, seat belts and shoulder harnesses for proper operation, condition and security of attachment. Inspect floorboards for condition and seat attachment. Check for operation of the seat stops.		
16. OXYGEN - Check the oxygen masks for cleanliness and stowage. Check the system for leakage. Replace any component that is leaking.		
17. VENTILATING SYSTEM - Check all fresh air and heat outlet vents for proper movement and operation.		
18. FUEL SELECTOR VALVE - Inspect for security, freedom of movement, proper detent feel and condition. Check for proper placarding.		
19. FILTERS - Replace individual instrument air filters.		
20. EMERGENCY EXIT HATCH - Check the emergency release handle and latch assembly for proper operation. Check that the hatch moves out freely. Check the complete hatch assembly for condition and all moving parts for proper operation. With the hatch installed, check for proper latching and seal.		
21. STATIC SYSTEM - Check and drain water from the static lines.		

F. NOSE SECTION	MECH	INSP
1. SKIN - Inspect skin for corrosion, condition, and loose or missing rivets. If damage is found, check adjacent structure.		
2. STRUCTURE - Check for corrosion, cracks, loose or missing rivets, and concealed damage.		
3. RADAR ANTENNA COVER - Check the fiberglass for security, attachment and cracks.		
4. BRAKE FLUID RESERVOIR - Check reservoir for security, attachment, open vent, proper fluid level and for leaks.		
5. ELECTRICAL WIRING AND EQUIPMENT - Inspect electrical wiring and associated equipment and accessories for condition, fraying, and attachment.		
6. HEATER FUEL SYSTEM - Check lines for connection and chafing.		
7. HEATER DUCTING AND WIRING - Check security and chafing.		
8. AIR CONDITIONER EVAPORATOR - Check for condition and attachment.		
9. OXYGEN (If applicable) - Inspect oxygen cylinder and valves for condition and security of attachment. Check the valves for proper condition.		
10. TAXI LIGHT - Check for security and operation. Replace if necessary.		
11. BAGGAGE DOOR - Check for condition and proper latching.		

F. NOSE SECTION (Cont'd)	MECH	INSP
12. PITOT MAST - Check for condition and obstruction. Check heating if applicable.		
G. REAR FUSELAGE AND EMPENNAGE	**MECH**	**INSP**
1. SKIN - Check for deformation, cracks and obvious damage. Check for loose or missing rivets. If damage is found, check adjacent structure.		
2. STRUCTURE - Inspect the two most aft bulkheads for cracks, distortion, loose rivets or other obvious damage.		
3. CABLES, PULLEYS AND TURNBUCKLES AND PRESSURE SEALS - Check the elevator and rudder flight control components, cables and pulleys. Replace control system components (push rods, turnbuckles, end fittings, castings, etc.) that have bulges, splits, bends, or cracks. Check control cables, pulleys, and associated equipment for condition, attachment, alignment, clearance, and proper operation. Replace cables that have broken strands or evidence of corrosion. Check cables for proper tension at the first inspection and every 100-hours thereafter.		
4. CONTROL SURFACES - Check for deformation, cracks and security. Check for loose or missing rivets. Check for freedom of movement and travel limits. Check for security of hinges and bond cable.		
5. STRUCTURE - Check for cracks, deformation and concealed damage.		
6. TRIM TABS AND ACTUATORS Check for security and wear. Check allowable free play as outlined in Chapter 27-20-00 and 27-30-00. Check hinges and trim tab actuator for security and wear. Check trim tabs for cracks and control rods for attachment. Lubricate the trim tab hinges as outlined in Chapter 12-20-00.		

G. REAR FUSELAGE AND EMPENNAGE (Cont'd)	MECH	INSP
7. RUDDER TORQUE TUBE (P-4 thru P-533 of S.I. 1115 has not been complied with) - Inspect the rudder torque tube for possible elongated taper pin holes and corrosion as outlined in BEECHCRAFT Service Instructions No. 1115.		
8. STATIC PORTS - Check for obstruction and clean as necessary.		
9. PLUMBING - Check for leakage, cracks, chafing, condition and security.		
10. ELECTRICAL WIRING AND EQUIPMENT - Inspect for chafing, damage, security and attachment.		
11. STATIC LINES - Check condition of static lines and drain.		
12. ASSIST STEP - Inspect for condition and attachment. The step may be adjusted as outlined under the heading STEP ADJUSTMENT (FOLDING POSITION) in Chapter 52-60-00.		
13. ANTENNAS - Check for condition and security.		
14. SCUPPER DRAINS - Check that the drain guards are open facing aft and drain holes are free from obstruction.		
15. OXYGEN (If applicable) - Inspect the oxygen cylinder and valves for condition and security of attachment. Check the valves for proper operation.		

H. MAIN GEAR AND BRAKES	MECH		INSP
	L	R	
1. BRAKES, LINES, LINING AND DISCS - Check for condition, wear and security. Check lines for chafing and signs of leakage or cracks. Check discs for wear or warping. Check brake discs for cracks.			
2. WHEELS AND TIRES - Check wheels for cracks and tires for wear, damage, condition and proper inflation. Check wheel bearings for condition and wear.			
3. LANDING GEAR STRUTS - Inspect the shock struts and components for cracks, attachment, corrosion, proper inflation and evidence of leakage.			
4. ACTUATING LINKAGE - Check for wear and cracks at attach points. Check for condition and security.			
5. GEAR DOORS AND LINKAGE - Check doors for damage and cracks to the structure and skins. Check linkage for wear and cracks at the attach points. Check for condition and security. Determine that all clevis retaining pins are in place and secured with cotter pins.			
6. STRUT FLUID LEVEL - Check and maintain the proper hydraulic fluid level in the struts as outlined in Chapter 12-20-00.			
7. STRUT AND A-FRAME HINGE BOLTS - Inspect for cracks and security of attachment.			

I. NOSE GEAR	MECH	INSP
1. WHEEL AND TIRE - Check wheel for cracks and tire for wear, damage, condition and proper inflation. Check wheel bearings for condition and wear.		

I. NOSE GEAR (Cont'd)	MECH	INSP
2. LANDING GEAR STRUT - Inspect the shock strut and components for cracks, attachment, proper inflation and evidence of leakage.		
3. ACTUATING LINKAGE - Check for wear at attach points. Check for cracks and security.		
4. GEAR DOORS AND LINKAGE - Check doors for damage and cracks to the structure and skins. Check linkage for wear and cracks at the attach points. Check for condition and security.		
5. NOSE GEAR STEERING LINKAGE - Inspect linkages for tightness, condition and security. Check linkage boots for condition.		
6. SHIMMY DAMPER - Check for condition and attachment. Check attach points for cracks. Check fluid level as outlined in Chapter 12-20-00.		
7. STRUT FLUID LEVEL - Check and maintain the proper hydraulic fluid level in the strut as outlined in Chapter 12-20-00.		
8. STRUT AND A-FRAME HINGE BOLTS - Inspect for cracks, corrosion and security of attachment.		
9. NOSE GEAR UPLOCK PIN - Remove and inspect for corrosion. Lubricate with MIL-G-81322 prior to reinstallation.		
10. NOSE GEAR ASSEMBLY (P-3 thru P-296) - After the first 1000 flight hours and each 1200 flight hours thereafter, inspect the nose gear assembly as noted in BEECHCRAFT Service Instructions No. 0669-206, Rev I (or subsequent).		

J. LANDING GEAR OPERATION	MECH	INSP
CAUTION Under no circumstances should the landing gear be operated electrically while the handcrank is engaged. In the event of such an operation, a teardown and magnetic inspection should be performed for damage to engagement slot in worm shaft. NOTE Since the battery voltage is not sufficient to properly cycle the landing gear for this inspection, use only an external power source capable of delivering and maintaining 28.25 ±.25 VDC, to the airplane's electrical system throughout the extension and retraction cycles when performing the landing gear retraction inspection. For more specific information which may be necessary to accomplish the following items, refer to Chapter 32-30-00.		
1. LANDING GEAR ACTUATOR ASSEMBLY - With the airplane on jacks and the retraction cycle started enough to break the downlock tension, apply a sharp load by hand in an aft direction against the nose gear strut. If this causes the main gear wheels to move approximately 1/2 to 1 inch, it is a good indication that the gear actuator assembly needs overhaul and/or adjustment.		
2. LANDING GEAR GEARBOX AND ACTUATING LINKAGE - Check for leakage, wear, condition and attachment. Check for unusual noise. Check oil level by engaging and turning the emergency handcrank 1/2 turn to determine that oil is being picked up on the worm gear. The oil level should be maintained no more than necessary to cover 1/2 of the diameter of the worm gear. Check actuator gearbox, motor and switches for leakage, condition and security.		
3. DOORS - Check door operation, fit and fair. Check for unusual noise.		

J. LANDING GEAR OPERATION (Cont'd)	MECH	INSP
4. GENERAL OPERATION - Cycle the landing gear while checking to ascertain that the position light switches operate in conjunction with the landing gear position. Check the condition and operation of the complete landing gear system as outlined in Chapter 32-30-00.		
5. POSITION LIGHTS - Check for security, adjustment, wiring for breaks, condition of insulation, loose connections and proper indication.		
6. EMERGENCY EXTENSION - Check system for freedom of operation and positive engagement of the downlocks. Check for unusual noise.		
7. LIMIT SWITCH RIGGING - Check for security and proper adjustment of the limit switches. Refer to Chapter 32-30-00 for correct landing gear gearbox internal clearance.		
8. DYNAMIC BRAKING ACTION - Verify proper operation of dynamic brake relay.		
9. WARNING HORN - Check for proper operation. NOTE Downlock tension should be checked at the first 100-hour inspection and every 200 hours thereafter.		
10. UPLOCK CABLE TENSION - Check uplock cable mechanism for condition and security. Check uplock cable for proper tension and for possible fraying.		
11. DOWNLOCK TENSION (MAIN GEAR) - Check for proper deflection force on the main gear knee joints.		

J. LANDING GEAR OPERATION (Cont'd)	MECH	INSP
12. DOWNLOCK TENSION (NOSE GEAR) - Check the downlock tension on the nose gear as outlined in Chapter 32-30-00.		
13. UPLOCK ROLLERS - Check condition and clearance of uplock rollers per Chapter 32-30-00 and lubricate as outlined in Chapter 12-20-00. Check for binding.		
14. SAFETY SWITCH - Check for security, proper rig and operation.		
15. NOSE GEAR UP TENSION - Check the up tension on the nose gear per Chapter 32-30-00.		
16. NOSE GEAR STEERING - Check for condition and security.		
K. GENERAL	MECH	INSP
1. Airplane cleaned and serviced.		
2. Airplane lubricated, after cleaning, as outlined in Chapter 12-20-00 and BEECHCRAFT Safety Communique No. 57 dated June 3, 1981.		
3. Inspect all placards to assure that they are easily readable and securely attached.		
4. Assure that all Airworthiness Directives, BEECHCRAFT Service Bulletins and previously issued Service Instructions are reviewed and complied with as required.		
For a complete or annual inspection of the airplane, all items on the airplane that are noted in this guide should be inspected.		

PILOT'S DISCREPANCIES	REMARKS

PILOT'S DISCREPANCIES	REMARKS

PROPELLER DEICER SYSTEM INSPECTION

The various components of the propeller deicer system should be inspected every 50 hours for the appearance of defects. The following inspection may provide a means of detecting and correcting such defects before they render the deicer system inoperative.

ELECTRIC PROPELLER DEICER (50-HOUR GUIDE)

a. Lock the brakes and operate the engines at near takeoff power. Turn the deicer system switch ON and observe the ammeter for at least 2 minutes. If the ammeter needle does not rest within the shaded band (except for a flicker that may occur when the step switch of the timer cycles) refer to the troubleshooting chart in Chapter 30-60-00 for the probable sources of trouble.

NOTE

Timers with electronic stepping circuits may not "flick" noticeably between cycles.

b. With the engine shut down, turn the deicer switch ON and feel the deicer boots on the propeller for the proper sequence of the heating elements. The presence of local hot spots indicates damage to the heating elements, which should be repaired before more serious damage develops.

CAUTION

When following the instructions of step "b", move the propeller back and forth to prevent arcing between the brushes and the slip ring.

WARNING

Before moving the propeller, make certain that the ignition switch is OFF and that the engine has cooled completely. There is always some danger of a cylinder firing when a propeller is moved.

c. Remove the spinner dome and open all access doors pertaining to the wiring and components of the deicer system. Turn the deicer switch ON and station an assistant in the pilot's compartment to observe the system ammeter. Flex all accessible wiring, particularly the lead straps, leads from the slip ring assembly, and the firewall electrical connectors and their wiring. Any movement of the ammeter, other than the cycling flicker that may occur when the step switch of the timer cycles, indicates a short or open circuit that must be located and corrected.

d. To extend the life of the lead strap between the hub clamp and clip, reposition the bend at least 1/2 inch from the existing location of the bend.

e. Check for damaged springs, and worn or damaged brushes.

ELECTRIC PROPELLER DEICER (100-HOUR GUIDE)

a. Check for radio noise or compass interference by operating the engines at near takeoff power with the radio gear turned ON. If, under these conditions, noise or interference occurs when the deicer systems switch is turned ON and disappears when the switch is OFF, refer to the troubleshooting chart for the probable source of trouble.

b. Check all clamps, clips, mountings, electrical connections, and connectors for tightness and electrical soundness. Check also for loose, broken, or missing safety wire.

c. Closely check deicer boots for wrinkles, loose, or torn areas, particularly around the outboard end and at the point where the strap passes under the hub clamp. Look for abrasions or cuts along the leading edge of the flat or thrust face. If the heater element wires are exposed in the damaged areas or if the rubber is found to be tacky, swollen, or deteriorated (as from contact with oil or solvent fluids), replace the boot.

d. Check that the hub clamps are tight. Inspect for cracks or other damage. Check to see that the cushioning material is not missing or damaged in the area under the hub clamp or on the edge of the spinner dome. Manually operate the propeller from low pitch to high pitch while checking that the deicer lead straps do not come under tension.

e. Check the slip rings for gouges, roughened surfaces, cracks, burned or discolored areas, and for deposits of oil, grease, or dirt. Clean greasy or contaminated slip rings with PD680 solvent (15, Chart 207, 91-00-00). After such cleaning, a run-in time of five hours of engine operation must be allowed before the deicer system is turned on.

f. If uneven wear or wobble is detected, check the alignment of the slip rings to the propeller shaft with a dial indicator. While turning the propeller to check the slip ring alignment, push in on the propeller to eliminate play in the propeller thrust bearing. If the runout over 360 degrees of rotation is over .005 inch, or if over any 4-inch arc it exceeds .002 inch, refer to step "h".

g. Examine the brush mounting brackets and housing for cracks, deformation, or other indications of damage. Check for tight connections and that the leads are not chafed or binding.

h. Check to see that each brush rides on its slip ring over 360 degrees of rotation. If the brush is not properly aligned, raise or lower the brush block to the proper position. If the brushes ride both high and low with respect to the slip rings in 360 degrees of rotation, the slip ring is eccentrically mounted and the shaft clamp or slip ring must be replaced.

i. Check for proper spacing between the brush block and slip rings. If this distance is not within the specified limits, loosen the mounting screws and reposition them in the elongated holes until the block is properly positioned. If necessary, shims can be added between the thrust bearing plate and mounting bracke until the brush is properly located.

j. Estimate the contact angle of th brush block in relation to the slip rings If this angle is not approximately degrees, loosen the mounting bolts an reposition the brush block until th proper angle exists between the brus block and slip rings. It should be note that the spacing established in step "i must also be maintained after proper con tact angle is obtained.

k. With the deicer system operatin and a man in the pilot's compartmen observing the ammeter, visually inspec and physically flex the wiring from th brush block to each component of th deicer system and to the airplane powe supply. Jumps of the ammeter needle, othe than the momentary flicker that may occu when the step switch of the timer cycles indicate loose or broken wiring in th area under examination at the moment. I such instances, continue to flex the wir ing in the area that first indicate trouble while checking the continuit through the individual wires of th affected harness until the source o trouble is located. Use the applicabl Wiring Diagram Manual to trace the circu itry of the deicer system.

CAUTION

While following the instructions of step "k", move the propeller back and forth to prevent arcing between the brushes and the slip ring.

WARNING

Before moving the propeller, make certain that the ignition switch is OFF and that the engine has cooled completely. There is always some danger of a cylinder firing when the propeller is moved.

"END"

CHAPTER 6

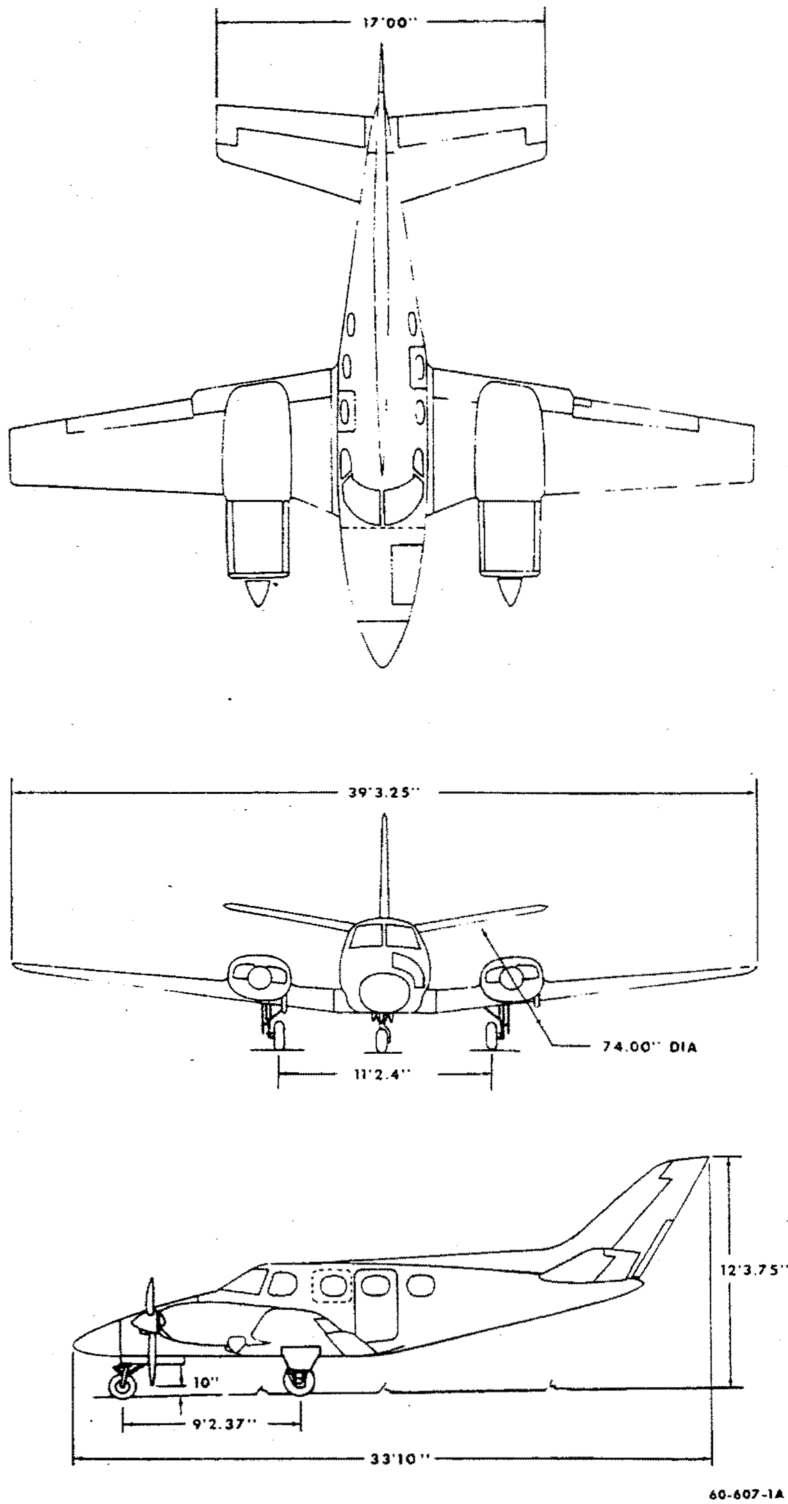
LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
6-EFFECTIVITY/CONTENTS	1	Nov 2/73
6-00-00	1	Nov 2/73
	2	Nov 2/73

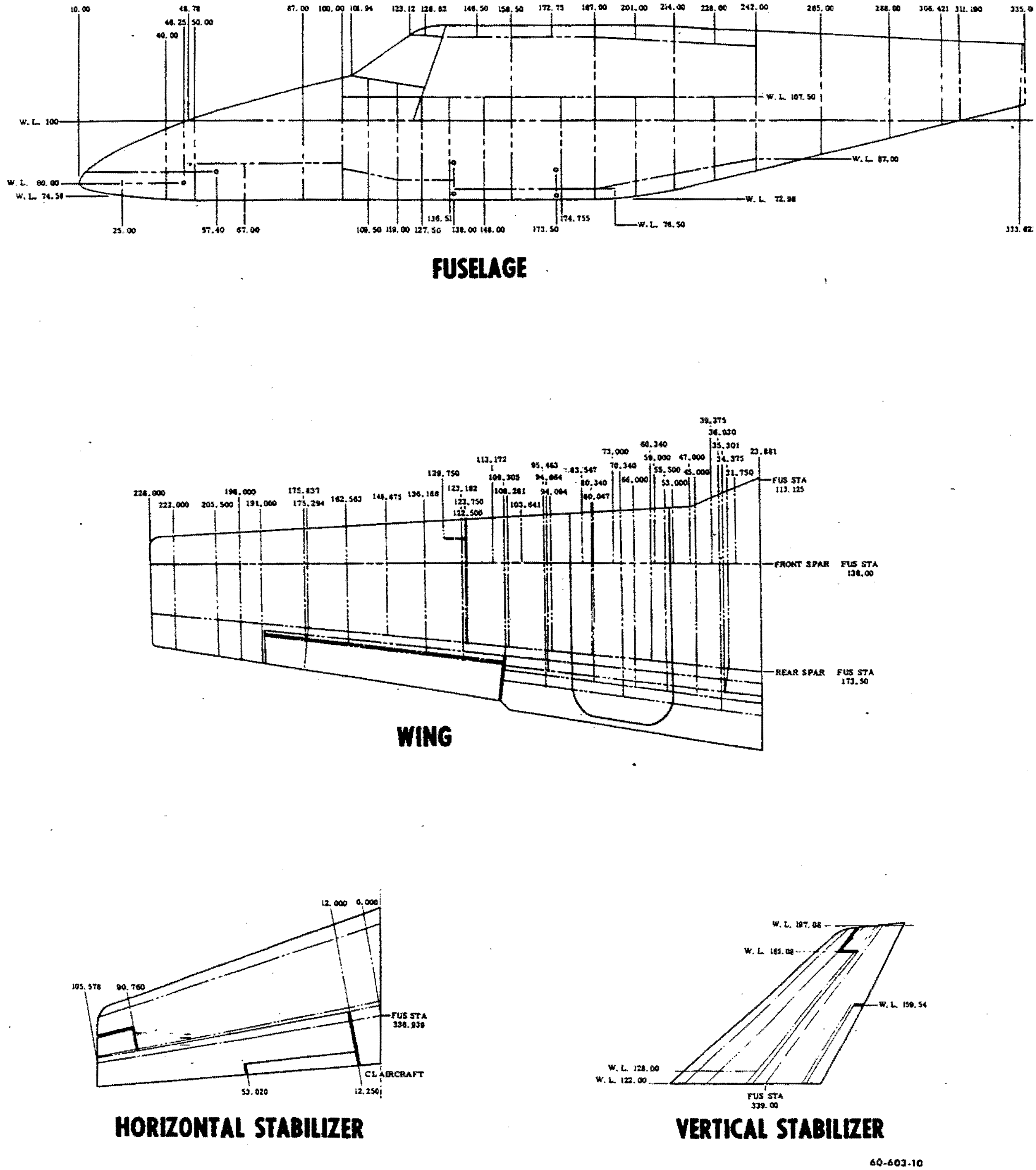
CHAPTER 6 - DIMENSIONS AND AREAS

TABLE OF CONTENTS

"END"



Aircraft Dimensions
Figure 1



Stations Diagram
Figure 2

"END"

CHAPTER 7

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
7-EFFECTIVITY/CONTENTS	1	Oct 27/75
7-00-00	1	Oct 27/75

CHAPTER 7 - LIFTING AND SHORING

TABLE OF CONTENTS

"END"

LIFTING AND SHORING - DESCRIPTION AND OPERATION

JACKING

CAUTION

Prior to jacking the airplane, ensure that an unbalanced condition does not exist. Fuel should be distributed evenly in both wings to prevent an unbalanced condition which could cause the airplane to be unstable while on jacks.

A three-point jack is used to lift the airplane off the ground. Each jack pad is identified and located on the under side of the fuselage. One jack pad is located on each lower wing-to-fuselage attachment fitting along the rear spar. The forward jack pad is located in the middle of the fuselage just aft of the nose gear wheel well.

The Model 400 service jack and three adapters (P/N 60-590013 on P-3 through P-61, 60-590013-1, P-62 and after) are designed to be used with this airplane.

When one engine or one wing is to be removed, a stand should be placed under the opposite wing and the tail to counteract the resulting unbalanced condition of the airplane. Individual main wheels may be jacked by placing a floor jack under the jacking point located under each axle.

"END"

CHAPTER 8

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
8-EFFECTIVITY/CONTENTS	1	Nov 2/73
8-00-00	201	Nov 2/73

CHAPTER 8 - LEVELING AND WEIGHING

TABLE OF CONTENTS

"END"

GENERAL - MAINTENANCE PRACTICES

LEVELING

The aircraft may be leveled longitudinally as follows:

a. Remove the phillips head screw from the upper level point, located just aft of the cabin door.

b. Install a screw, approximately three inches long, in the upper level point nutplate.

c. Attach a cord and plumb bob to the outboard end of the screw installed in step "b".

d. Inflate or deflate the nose gear shock strut as necessary to pass the cord through the center of a second level point directly below.

NOTE

Suspending the plumb bob in a can of light engine oil will assist in stabilizing it.

Lateral leveling is accomplished by placing a bubble level on the rear spar and deflating the tire or shock strut on the high side of the aircraft to center the bubble.

"END"

CHAPTER 9

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
9-EFFECTIVITY/CONTENTS	1	Nov 2/73
9-00-00	201	Nov 2/73

CHAPTER 9 - TOWING AND TAXIING

TABLE OF CONTENTS

"END"

GENERAL - MAINTENANCE PRACTICES

Attach the hand towbar to the tow lug on the nose gear lower torque knee.

CAUTION

When towing with a tug, observe turn limits as placarded on the nose gear to prevent damage to the gear.

CAUTION

Do not push on propeller or control surfaces. Do not place your weight on the horizontal stabilizers to raise the nose wheel off the ground.

"END"

CHAPTER 10

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
10-EFFECTIVITY/CONTENTS	1	Nov 2/73
10-00-00	1	Nov 2/73

CHAPTER 10 - PARKING AND MOORING

TABLE OF CONTENTS

"END"

GENERAL - DESCRIPTION AND OPERATION

PARKING

The brakes are set for parking by pulling out the parking brake control and depressing the pilot's brake pedals to pressurize the system. Do not attempt to lock the parking brake by applying force to the parking brake handle; it controls a valve only, and cannot apply pressure to the brake master cylinders.

MOORING

Three mooring eyes are provided; one in each wing and one on the lower aft fuselage. To moor the airplane, chock the wheels fore and aft, install the control lock and tie down the aircraft with a nylon line or chain of sufficient strength at each mooring eye. Avoid overtightening the rear line, which pulls the nose up so that wind will create higher lift on the wings. If bad weather is anticipated, it is advisable to nose the airplane into the wind.

NOTE

Do not set the parking brakes during low temperatures when an accumulation of moisture may cause the brakes to freeze, or when they are hot from severe use.

"END"

CHAPTER 11

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
11-EFFECTIVITY/CONTENTS	1	Apr 18/80
11-00-00	1	Apr 18/80

CHAPTER 11 - PLACARDS AND MARKINGS

TABLE OF CONTENTS

"END"

PLACARDS AND MARKINGS - DESCRIPTION AND OPERATION

MODEL DESIGNATION PLACARD

The model designation placard is located on the left side of the fuselage adjacent to the inboard end of the flap. The flaps must be lowered to observe the placard. The placard identifies the airplane by its model number and serial number. Should a question arise concerning the care of the airplane, it is important to include the airplane serial number in any correspondence to Beech Aircraft Corporation.

NOTE

Ascertain that all placards are in place and legible whenever the airplane has been repainted or touched up after repairs. Replace any placards that have been inadvertently defaced after such repainting or repairs.

"END"

CHAPTER 12

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
12-EFFECTIVITY	1	Jan 9/86
12-CONTENTS	1	Nov 30/83
12-00-00	1	Oct 19/77
12-10-00	201	Jan 9/86
	202	Jan 9/86
	202A	Jan 9/86
	203	Nov 2/73
	204	Nov 2/73
	205	Nov 2/73
12-20-00	201	May 12/78
	202	May 12/78
	202A	May 12/78
	203	Apr 18/80
	204	Nov 2/73
	205	Nov 30/83
	206	Nov 30/83
	207	Nov 30/83
	208	Nov 30/83
	209	Nov 30/83
	210	Nov 30/83
	211	Nov 30/83
	212	Nov 30/83
	212A	Nov 30/83
	212B	Nov 30/83
	213	Feb 22/80
	214	May 30/75
	215	Nov 2/73
	216	May 30/75
	217	May 30/75
	218	May 30/75
	219	May 30/75
	220	May 30/75
	221	Nov 2/73
	222	Nov 2/73
	223	Nov 2/73
	224	Oct 27/75
	225	Oct 27/75
	226	Nov 2/73
	227	Nov 30/83
	228	Oct 27/75

"END"

CHAPTER 12 - SERVICING

TABLE OF CONTENTS

"END"

GENERAL - DESCRIPTION AND OPERATION

The information in this chapter pertains to general servicing procedures and maintenance practices used when servicing the various systems of the airplane. Detailed maintenance information pertaining to these systems will be found in the applicable following chapters. For overhaul procedures for components of a system refer to the BEECHCRAFT Duke 60 Beech Manufactured Components Maintenance Manual, P/N 60-590001-27. For electrical wiring diagrams refer to the BEECHCRAFT Duke 60 Wiring Diagram Manual, P/N 60-590001-29.

"END"

REPLENISHING - MAINTENANCE PRACTICES

FILLING THE FUEL CELLS

NOTE

Because the deice boots are made of soft flexible material, care must be exercised against dragging gasoline hoses over them or resting ladder or platforms against the surface of the boots.

The fuel system installation consists of an inboard main fuel cell and an outboard cell in the leading edge, a nacelle tank, a wing panel fuel cell in each wing and a wet wing tip tank (optional on serials P-348, P-365 and after). All of the fuel cells in each wing and wing tip are interconnected in order to make all of the usable fuel in each wing available to its engine when the fuel selector valve is turned ON. The interconnecting fuel cells are serviced either through the single filler on each wing or the filler in each of the optional wet wing tips, providing single point filling for each side. The fuel sight gage (P-402 and after) located outboard of each nacelle may be used for partial filling of the fuel system, or for balancing the fuel load, when the fuel load is within the range of this gage (40 to 60 gallons for each wing). The combined capacity of the standard and optional system is shown below:

SERIALS	CAPACITY IN GALLONS	USABLE IN GALLONS
P-3 thru P-195 inboard leading edge fuel cells unbaffled	207	192
P-3 and after with inboard leading edge baffled fuel cells	207	202
Optional fuel system P-348, P-365 and after	237	232

When filling the airplane fuel cells, always observe the following:

a. Service the fuel cells with grade 100 (blue) or 100LL (green) fuel or if not available, use 115/145 octane fuel (1, Chart 202, 12-20-00).

b. Make sure the airplane is statically grounded to the servicing unit.

c. Do not fill fuel cells near open flame or within 100 feet of any open energized electrical equipment capable of producing sparks.

d. Do not insert the fuel nozzle more than 3 inches into the filler neck; to do so may cause damage to the rubber fuel cell.

DRAINING THE FUEL SYSTEM

To ensure that all fuel is removed from the system, the fuel should be drained through the boost pumps. To expedite the defueling operation, the boost pumps may be used to pump the fuel out of the system. The following steps must be accomplished before energizing the pumps:

a. Apply external power to the airplane electrical system.

b. Place the fuel selector valve in the ON position and the mixture lever in the IDLE CUT-OFF.

c. Remove the filler caps to vent the system.

d. Disconnect the fuel line at the firewall and attach a drain hose. Provide a suitable container for the fuel.

e. Energize the boost pumps.

f. When fuel is no longer pumped from the airplane, open the sump drains to complete the defueling operation.

ENGINE FUEL FILTERS AND SCREENS

Most fuel injection system malfunctions can be attributed to contaminated fuel. Inspecting and cleaning the fuel strainers should be considered to be of the utmost importance as a regular part of preventive maintenance.

Normally the fuel strainers should be inspected and cleaned every 100 hours. However, the strainers should be inspected and cleaned at more frequent intervals depending on service conditions, fuel handling equipment, and when operating in localitites where there is an excessive amount of sand or dust.

Open each of the seven snap-type fuel drains daily to allow condensed moisture to drain from the system. On the optional system (P-348, P-365 and after) open the fuel drain in the wet wing tip using the special tool P/N 101-590020-1.

NOTE

If the cells are to remain unfilled for 10 days or more, apply a thin coating of light engine oil to the inside surface of the cell to prevent deterioration and cracking.

OIL SYSTEM

The engines are equipped with a wet sump, pressure type oil system. Each engine sump has a capacity of 13 quarts. The oil system may be checked through access doors in the engine cowling. A calibrated dip stick attached to the filler cap indicates the oil level. Due to the canted position of the engines, the dip sticks are calibrated for either right or left engines and are not interchangeable. The oil should be changed every 75 to 100 hours under normal operating conditions and the oil filter changed every 50 hours.

CAUTION

Any Time the oil system has been contaminated by metal particles, the oil cooler must be replaced and the oil system flushed to prevent engine damage.

All TIO-541 series engines are limited to using only MIL-L-22851 ashless dispersant multi-grade oil (2, Chart 202, 12-20-00). Oil equivalent to SAE 50 or SAE 60 above 60°F; below 30°F SAE 40 is recommended. However, newly overhauled engines of this series may be run-in on the test stand with single viscosity, grade SAE 50 oil conforming with MIL--L-6082, (6, Chart 202, 12-20-00).

The oil drain is accessible through the cowl flap opening. The engines should be warmed to operating temperature to assure complete drainage.

NOTE

The engine oil must be of the proper viscosity and meet the requirements of the current Avco Lycoming specification 301 and Avco Lycoming Service Instruction 1014K or subsequent.

The determining factor for choosing the correct grade of oil is the oil inlet temperature observed furing flight; however, inlet temperatures consistently near the maximum allowable indicate a heavier oil is needed. Lycoming recommends use of the lightest weight oil that will give adequate cooling.

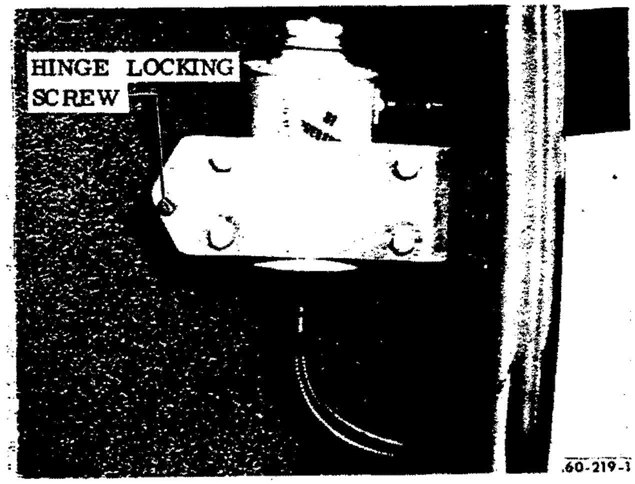
CHANGING THE OIL FILTER

The oil filter should be replaced every 50 hours. Replace the filter as follows.

a. Disconnect the fuel line to the inlet side of the engine-driven fuel pump. Cap the fuel line (P-3 through P-20) and push the line down to allow clearance for oil filter removal.

b. Cut the safety wire and remove the filter housing.

c. After making sure all traces of gasket material and cement are removed from the oil filter adapter recess, install



Brake Fluid Reservoir
Figure 201

the new aluminum ring and O-ring seal which replace th existing rubber gasket. (Refer to Lycoming Service Bulleti No. 337.)

d. Torque the retainer bolt to 30-35 foot-pounds an safety.

e. Remove cap (P-3 through P-20) and reinstall th fuel line.

BRAKE SYSTEM
(Figure 201)

Brake system servicing is limited primarily to maintaining th hydraulic fluid level in the reservoir. The brake fluid reservoi accessible through the forward baggage compartment doo is hinged on the aft frame of the door.

Loosening the screw securing the reservoir to the airplar structure allows the reservoir to swing out for easy servicin Fill the reservoir with MIL-H-5606 hydraulic fluid (13, Cha 202, 12-20-00) to the full mark on the dip stick. Mainta fluid level between "full" and "add" marks. Do not overfi For detailed information relating to the proper inspectic and repair procedures for the brake assembly, refer to th Beech Manufactured Component Maintenance Manua P/N 60-590001-27.

AIR CONDITIONING SYSTEM

Servicing the air conditioning system consits of periodical checking the refrigerant level, checking compressor oil leve and changing the system air filter. Recharge the system a outlined under CHARGING THE AIR CONDITIONING SYS TEM whenever the refrigerant level is low, air has entered th system, or components carrying refrigerant are replace Refrigerant leaks may be detected by inspection with flameless leak detector.

CHARGING THE AIR CONDITIONING SYSTEM

When working on a refrigerative air cooling system, observe the following special servicing precautions:

a. Remember, this is a high pressure system. When disconnecting a line, loosen the fittings just enough to bleed off pressure slowly, then disconnect the fitting.

b. Whenever a line is disconnected, purge the entire system with a vacuum pump operating at the 125 micron level.

c. Use only R-12 refrigerant (17, Chart 202, 12-20-00) in this system. Other refrigerants, particularly those containing methyl chloride, will cause rapid deterioration of the aluminum compressor components.

d. When servicing the system with refrigerant, avoid smoking or working near an open flame. Refrigerant passing over an open flame will produce a highly toxic phosgene gas.

Hook the service unit to the connections on the compressor. The abbreviation DISCH or the letter D on the compressor cylinder head designates the discharge service valve. The word SUCTION or the letter S on the compressor cylinder designates the suction service valve. When charging a completely purged system, charge with 5 pounds of refrigerant. After charging, the sight glass should be observed for bubbles or a milky appearance caused by an insufficient refrigerant level.

If it is necessary to add refrigerant to a partially charged system, add refrigerant slowly until a satisfactory condition is observed through the sight glass, then add an additional ¼ to ½ pound of refrigerant.

NOTE

After the system has been charged, the compressor oil level should be checked as outlined under CHECKING COMPRESSOR OIL LEVEL.

CHECKING COMPRESSOR OIL LEVEL (Figure 202)

The compressor oil level should be checked by a qualified air conditioner man at the following times:

a. After the air conditioner has operated for the first time.
b. At the beginning of each season's operation.
c. When oil is emitted from the compressor during servicing operation.
d. After the air conditioning system has been recharged.
e. If a component is replaced.

The compressor is charged with Texaco Capella E or Suniso No. 5 oil (18, Chart 202, 12-20-00). Only these or equivalent oils should be used when adding oil. To check the compressor oil level, use the following procedure:

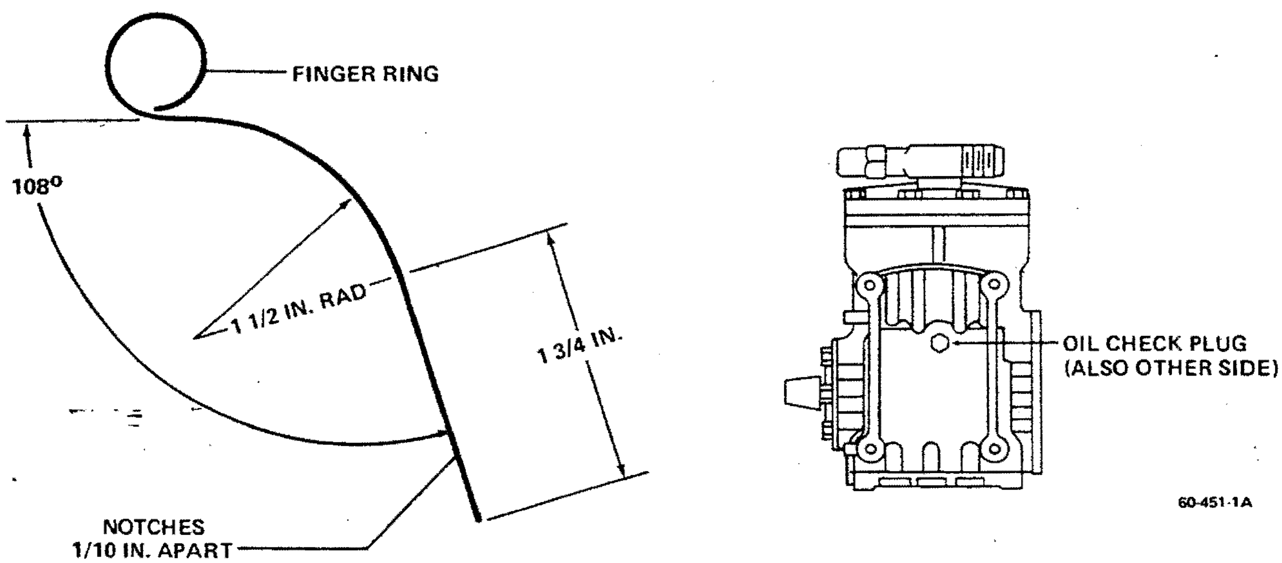
a. Operate the air conditioner for approximately 15 minutes in which the last 5 minutes should be at low engine rpm (1,000 to 1,100). This allows the oil to accumulate in the compressor for an accurate oil level reading.
b. Attach service gages to compressor service valve ports.
c. With air conditioner operating, slowly close the suction service valve until the suction pressure gage reads zero or slightly below.
d. Stop the air conditioner and quickly close the suction service valve when the suction gage reads a little above zero.
e. Close the discharge service valve.
f. With both service valves closed, the suction pressure will slowly rise to about five pounds gage pressure.
g. The remaining pressure is relieved by unscrewing the plug for 5 full turns and bleed to zero pressure.
h. Remove the oil plug and O-ring.
i. To place the crank throw in the best position for dip stick insertion, point the keyway on the compressor shaft up toward the cylinder head.
j. Insert an oil dipstick until the end contacts the bottom of the crankcase. Remove and measure the oil depth.

NOTE

A compressor oil level depth of 1.5 to 1.8 inches is satisfactory. If the oil level is below 1.5 inches, add oil per Chart 202, then remeasure.

CHART 202
CHECKING COMPRESSOR OIL LEVEL

Dip Stick Depth (In.)	Oil to be Added (Oz.)
.6	8.0
.8	6.5
1.0	5.0
1.2	3.0
1.4	1.5



Dipstick and Compressor Oil Check Plug
Figure 202

Oil should be removed when depths greater than 1.8 inch are observed.

Compressor oil level reduces .4 to .7 inches during operation at maximum rpm and also drops slightly with reduced evaporator loads. Approximately 7 ounces of oil is required to initially wet the system and circulate with the refrigerant. When an evaporator or condenser coil is changed, add approximately 2 ounces of oil on installation, then check and adjust the oil level as recommended. A locally manufactured dip stick (see Figure 202) may be fabricated from 1/8 inch diameter rod; a nonferrous material, which is not subject to corrosion, is preferred. Notches cut 1/10 inch apart will aid in visually detecting oil depth.

k. Install the oil plug and O-ring and check for leaks using a flameless leak detector.
l. Unseat both the suction service valve and the discharge service valve and turn to the full aft position.
m. Remove the service gages and install the caps to the service ports.
n. The aircraft may now be returned to service.

EVAPORATOR AIR FILTER REPLACEMENT

The evaporator air filter should normally be replaced annually. Actual replacement may be required more often due to extremely dusty operating conditions.

a. Remove the necessary equipment in the nose compartment to gain access to the floorboards forward of the pressure bulkhead.
b. Remove the screws securing the top of the evaporator filter access plate.
c. Cut the cord securing the filter to the evaporator plumbing.
d. Remove the old filter.
e. When installing the new filter, be sure the reinforced backing of the filter is placed against the evaporator coil.

COMPRESSOR BELT TENSION ADJUSTMENT

After 36 to 48 hours operating time, a new belt will stretch to its normal operating length. The belt tension should be checked at this time and adjusted (by moving the compressor up and down in its slotted mounts) so that a belt tension gage, placed at a point midway between the longest span will register a tension of 100 to 105 pounds. After adjusting tension on a new belt, be sure the belt has ample clearance on all sides.

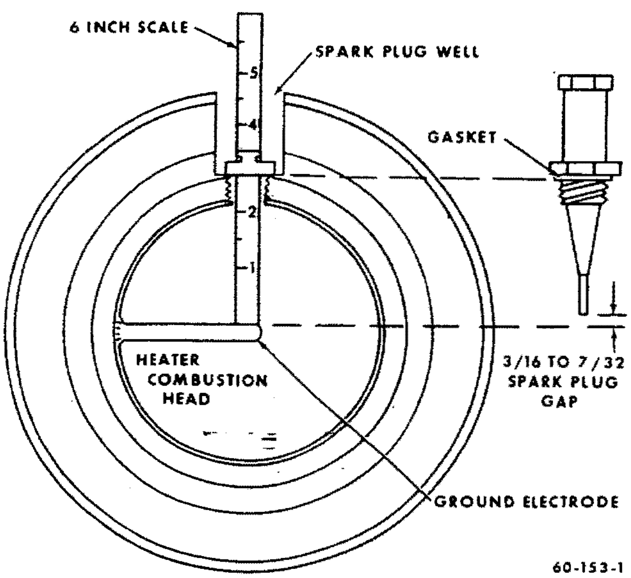
HEATING SYSTEM

HEATER SPARK PLUG
(Figure 203)

If the spark plug appears to be in good condition, except for a mild coating of oxide on the procelain and electrodes, it may be cleaned and reused. Cleaning is accomplished on a conventional aircraft type spark plug cleaner, except that it will be necessary to use two or more adapters in order to raise the long extension of the plug far enough out of the cleaner nozzle opening to provide an effective job. Plug the ceramic insert cavity at the terminal end of the plug with a piece of paper or cloth to keep out any of the cleaning sand. Wipe this cavity out thoroughly with a cloth, wet with carbon tetrachloride. If, after cleaning, the spark plug porcelain is white, and the electrode is not eroded, the spark plug gap may be set as follows: Insert a six inch scale with a sliding clip into the spark plug well until it touches the ground electrode welded inside the combustion head. Withdraw the scale and note the dimension between the sliding clip and the end of the scale. Place the scale against the bottom of the spark plug gasket and determine the length of the spark plug positive electrode. The difference between the two measurements is the spark plug gap. The gap should be 3/16 to 7/32 (.188 to .218) inches. If the plug gap must be adjusted, the ground electrode may be bent up or down by reaching through the spark plug hole with the appropriate shaped tool.

NOTE

If the spark plug fails to clean up properly and/or if the electrode is badly eroded, it should be replaced.



Heater Spark Plug Gap
Figure 203

If a new spark plug is being installed, be sure to measure the gap. Do not bend the positive electrode. Torque the spark plug to 28 foot-pounds.

NOTE

The spark plug can be checked visually for sparking prior to installing the plug as follows: Disconnect the wire from the terminal on the heater wiring side of the terminal strip to de-energize the fuel solenoid valve. Connect the high-voltage lead temporarily and lay the spark plug on the heater jacket.

WARNING

Be sure to plug the spark plug hole in the heater to prevent any possibility of residual fuel blowing out and igniting. Do not touch the spark plug while energized because of dangerously high voltage.

OXYGEN SYSTEM

CAUTION

All persons handling and servicing oxygen systems should review proper precautions to be observed during servicing. FAA Advisory Circular 43.13-1 contains the necessary information.

The oxygen system consists of an oxygen regulator, six outlets, a nose or rear mounted cylinder and recharging valve. The system may be fitted with an 11, 22, 49 or 65 cubic foot cylinder. When the system is not in use, the control valve on the console should be shut off to prevent oxygen loss.

To recharge the oxygen system, remove the protective cap from the filler valve.

WARNING

Keep fires, cigarettes and sparks away when outlets are in use. Open and close all oxygen valves slowly. Inspect the filler connection for cleanliness before attaching it to the filler valve. Keep tools, hands and components clean, as fire or explosion may occur when pure oxygen under pressure comes in contact with organic material such as grease or oil.

Attach a hose from an oxygen recharging cart to the filler valve. To prevent overheating, fill the oxygen system slowly by adjusting the recharging rate with the pressure regulating valve on the cart. The oxygen cylinder should be filled to a pressure of 1800 ± 50 psi at a temperature of 70°F. This pressure may be increased an additional 3.5 psi for each degree of increase in temperature; similarly, for each degree of drop in temperature, reduce the pressure by 3.5 psi. When the oxygen system is properly charged, disconnect the hose from the filler valve and replace the protective cap. If at any time, in the process of servicing and purging the system or replacing the oxygen cylinder, it becomes necessary to disconnect a fitting, the threads should be treated with MIL-T-27730 tetrafluoroethylene tape (Chart 201, 12-20-00). The system should then be checked for leaks with MIL-L-25567 leak testing compound (14, Chart 202, 12-20-00). After testing, if no leaks are found, wipe the system clean and dry.

"END"

SCHEDULED SERVICING - MAINTENANCE PRACTICES

TIRES

NOTE

"Aero Seal" is a tire additive which is very effective in stopping small leaks and weep-hole leaks in tubeless tires. The proper procedure for the use of this additive may be obtained by referring to Service Instructions No. 0916.

The nose gear is equipped with a 15 x 6.00 x 6, 4 ply, type VI, tube type tire. The main gear tires are either 6.50 x 8, 8 ply tubeless, rim-inflated type (P-4 through P-191, except P-190) or 19.5 x 6.75 x 8, 10 ply, tube type (P-190 and after, except P-191 and those airplanes prior to P-190 which have complied with Service Instructions No. 0536-202, Rev II). A maximum outside diameter of 15 inches on the nose gear tire is required to ensure proper clearance of the nose gear shock absorber assembly. Inflate the nose gear tire to 47-50 psi. Inflate the 8 ply main gear tires to 69-75 psi and the 10 ply main gear tires to 76-82 psi. If necessary to comply with landing restrictions, main gear tire inflation may be reduced to 65 psi for 8 ply tires. Maintaining recommended tire inflation will help to avoid damage from landing shock and contact with sharp stones and ruts, and will minimize tread wear. When inflating tires, inspect them visually for cracks, breaks or evidence of external damage.

EXTERNAL POWER

The airplane electrical system is protected against damage from reverse polarity by a relay and diodes in the external power circuit. The external power receptacle is located just outboard of the left engine nacelle. The receptacle is designed for a standard AN type plug. To supply power for ground checks and air conditioner operation, a ground power source capable of delivering a continuous load of 300 amperes at 24 to 30 volts is required. Use of an inadequate ground power unit can cause a voltage drop below the dropout voltage of the starter relay, resulting in relay chatter and welded contacts. By the same token, a maximum continuous load in excess of 350 amperes will damage the external power relay and power cables of the airplane. Observe the following precaution when using an external power source.

a. Use only an auxiliary power source that is negatively grounded. If the polarity of the power source is unknown, determine the polarity with a voltmeter before connecting the unit to the airplane.

b. Before connecting the external power unit, turn off all radio equipment and generator switches, but leave the battery on to protect transistorized equipment against transient voltage spikes.

CAUTION

When the battery switch is turned off for extended ground power operation, place an external battery in parallel with the output of the external power unit before operating any transistorized avionics equipment.

c. If the unit does not have a standard AN plug, check the polarity and connect the positive lead from the external power unit to the center post and the negative lead to the front post of the airplane's external power receptacle. The small pin of the receptacle must be supplied with + 24 vdc to close the external power relay that provides protection against damage by reverse polarity.

BATTERY

Airplanes prior to P-446 are equipped with 24 volt, 13.5 ampere-hour batteries. To obtain optimum service from the nickel-cadmium battery, proper and regular maintenance of the battery must be performed.

Serials P-4 through P-225 are equipped with either General Electric or Gulton batteries. Serials P-226 through P-445 are equipped with General Electric air cooled batteries.

Airplanes, P-446 and after, are equipped with two 25 ampere-hour, 12 volt, lead-acid batteries connected in series and supplying a total system capacity of 24 volts.

A Systematic Battery Maintenance Program should be established and carefully followed:

a. The battery should be removed from the airplane for service.

b. A log of the services performed on each battery should be maintained.

c. The battery should be removed from the airplane and serviced after: 100 Flight Hours or 30 days, whichever occurs first. If the ambient temperatures are above 90°F or the time between engine starts averages less than 30 minutes, the duty cycle should be reduced.

d. The log of battery services performed should be evaluated to determine the need to service the battery at the above recommended intervals or to extend the intervals if justified. Accurate water consumption data is a valid barometer to use for adjustment of the servicing intervals.

CAUTION

Methods of servicing lead-acid batteries do not apply for the servicing of nickel-cadmium batteries.

Since the proper servicing of nickel-cadmium batteries requires two days, an additional battery (or batteries) will be required where airplane utilization warrants. For additional information on battery maintenance, refer to Gulton Instructions for Use and Care of Sintered Plate Vented Nickel-Cadmium Storage Batteries (P/N ABD-1100), or Marathon Battery Instruction Manual (P/N BA-89), or Operating and Service Manual for General Electric Nickel-Cadmium Vented-Cell Batteries (P/N GET-3593A), which ever the airplane is equipped with. Advisory Circular AC 00-33, printed by Department of Transportation, Federal Aviation Administration, is another good source of battery maintenance information.

DEICE BOOTS

Because the deice boots and related components operate on clean air supplied from the pressure manifold, little is required in the form of servicing the system. The boots should be checked for engine oil after servicing and at the end of each flight, and any oil found should be removed. This can be accomplished by the use of a neutral soap and water solution. Care should be exercised to avoid scrubbing the surface of the boot as this will tend to remove the special conductive surfacing.

NOTE

Because the deice boots are made of soft flexible material, care must be exercised against dragging gasoline hoses over them or resting ladder or platforms against the surface of the boots.

For surface deice boot maintenance, refer to Chapter 30-10-00.

SHOCK STRUTS

The shock struts are filled with compressed dry air or nitrogen and MIL-H-5606 or MIL-H-83282 hydraulic fluid (13, Chart 202). The same procedure is used for servicing both the main and nose gear shock struts. The shock strut may be serviced as follows:

a. Remove the air valve cap and depress the valve core to release the air pressure.

CAUTION

Do not unscrew the air valve assembly until the air pressure has been released or it may be blown off with considerable force, causing injury to personnel or property damage.

b. Remove the air valve assembly.

c. Compress the strut and fill through the air valve assembly hole with MIL-H-5606 or MIL-H-83282 hydraulic fluid (13, Chart 202) (approximately one pint) until the fluid overflows.

d. Cycle the strut (full extension to compressed) and refill. Repeat until fluid can not be added to the strut in the compressed position.

NOTE

Cycling of shock strut is necessary to expel any trapped air within the strut housing.

e. Install the air valve assembly.

f. With the airplane resting on the ground and the fuel cells full; inflate the nose gear strut until 4-1/16 to 4-5/16 inches of the piston is exposed, and inflate the gear strut until 3 inches of pistion is exposed. Rock the airplane gently to prevent possible binding of the pistion in the barrel while infating.

NOTE

It is recommended that the nose strut inflation dimension and the tire inflation pressure be carefully adheared to. Properly inflated tires and struts reduce the possibility of ground damage occurring to the propellers. Exercise caution when taxiing over rough surfaces.

g. The shock strut pistion must be clean. Remove foreign material by wiping the strut with a cloth dampened in hydraulic fluid.

PROPELLER BLADE BEARING LUBRICATION (Figure 201)

a. Remove the propeller spinner.

b. Remove the safety wire and covers from the six zerks. See Figure 201 for location.

c. Remove one zerk from each blade.

d. Lubricate the blade bearings with Hartzell DG Grease by placing the grease gun fitting on the remaining zerk of each blade. Fill until the grease is visible in the hole where the opposite zerk was removed.

e. Reinstall the zerk on each blade.

f. Clean excess grease from the propeller, reinstall the grease zerk covers and safety.

g. Reinstall the spinner.

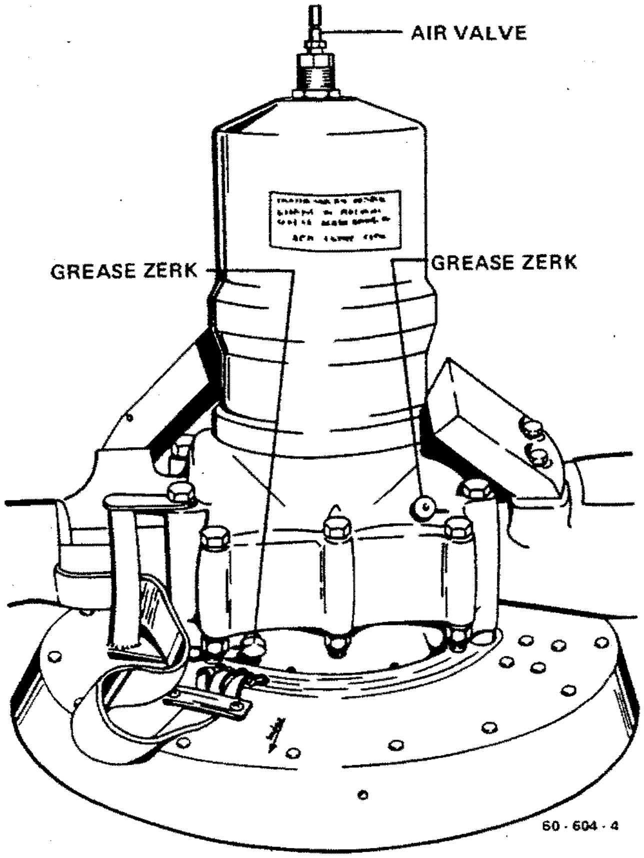
PROPELLER SERVICING POINTS
(Figure 201)

a. Remove the access cap from the propeller spinner to expose the filler valve.

b. Charge the dome with dry air or nitrogen to a pressure of 80 psi at 70°F. Increase the pressure an additional 2 psi for every 10 degrees of increase in temperature similarly for every 10 degrees of drop in temperature, reduce the pressure by 2 psi.

PROPELLER ACCUMULATOR

The propeller accumulators are located on the lower rear section of each engine. The accumulators should be inspected every 100 hours and charged with dry air or nitrogen to 125 psi. If a unit will not hold 70% of its normal charge, from inspection to the next, it should be replaced.



Propeller Servicing Points
Figure 201

INDUCTION AIR FILTER (Wet or Dry Element)

The induction air filter should be cleaned every 50 hours and replaced every 500 hours of service. Clean the filter as specified by the manufacturer's instructions stamped on the filter.

ROTON LOCKS (Figure 202)

Usually, Roton locks will need no service. If there is a grinding and binding in the lock as the seat reclines or the return action becomes jerky, a little grease properly applied as follows should improve the operation.

a. Apply grease (30, Chart 207, 91-00-00) to the threads as shown in Figure 202.

b. Compress the spring guide and counter-balance spring approximately one inch.

c. Remove the retaining ring.

d. Relax pressure on the spring guide and counter-balance spring slowly until the spring is fully extended.

e. Remove the lock from the fixture and remove the spring guide; counter-balance spring, and spring guide tube.

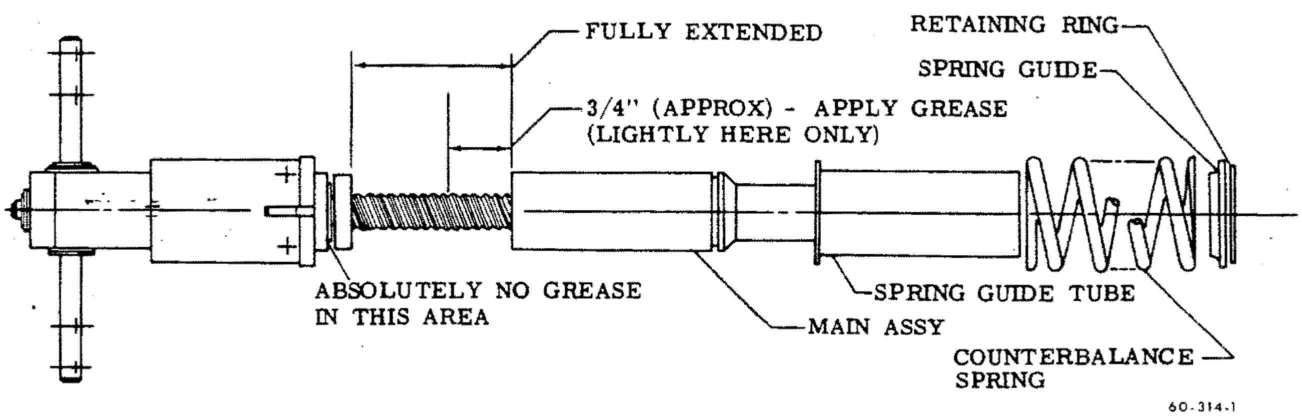
f. Apply a small quantity of grease to the completely extended thrust screw.

g. Reassemble the lock. For service other than lubrication a new lock will need to be purchased.

CLEANING AND WAXING THE AIRPLANE FINISH

Because the wax seals the paint from the outside air, a new paint job should not be waxed for a period of 90 days to allow the paint to cure. Wash uncured painted surfaces with only cold or lukewarm (never hot) water and a mild non-detergent soap. Any rubbing of the painted surface should be done gently and held to a minimum to avoid cracking the paint film.

After the paint cures, a thorough waxing will protect painted and unpainted metal surfaces from a variety of



Roton Lock
Figure 202

highly corrosive elements. Flush loose dirt away first with clear water, then wash the airplane with a mild soap and water. Harsh, abrasive, or alkaline soaps or detergents should never be used. Use soft cleaning cloth or chamois to prevent scratches when cleaning and polishing. Any good grade automobile wax may be used to preserve painted surfaces. To remove stubborn oil and grease, use a soft cloth dampened with naphtha. After cleaning with naphtha, the surface should be polished and rewaxed.

NOTE

Frequently inspect the underside of the wing and flaps in the area covered by the engine turbocharger exhaust stream for fuel lead deposits. If such deposits are discovered, they should be removed immediately with a water and mild detergent solution and the surface rewaxed.

CLEANING PLASTIC WINDOWS

A commercial cleaning compound made specifically for acrylic plastic windows may be used. When using a commercial cleaner, follow the instructions on the container.

If a commercial cleaner is not available, the following instructions should be followed:

Cleaning of the acrylic plastic windows should never be attempted when dry. The window should first be flushed with water or a mild soap solution, then rubbed slightly with a grit-free soft cloth, chamois or sponge. Stubborn grease or oil deposits are readily removed with aliphatic naphtha or hexane. Rinse with clear water.

CAUTION

Do not use thinner or aromatic abrasive cleaners to clean the windows as they will damage the surface of the plastic. Aliphatic naphtha and similar solvents are highly inflammable, and extreme care must be exercised when used.

CHART 201
THREAD LUBRICANTS

The vendor products appearing in this chart have been selected at random to help field personnel determine products conforming to the specifications listed in this publication. The brand names are listed for ready reference and are not specifically recommended by Beech Aircraft Corporation. Any product which conforms to the referenced specification may be used.

SYSTEM	*MATERIAL*	*SPECIFICATION*	*VENDOR PRODUCTS*
Fuel	Petrolatum	VV-P-236	
Oil, Manifold Pressure, Air Pressure	Lubricating Grease (Gasoline and Oil Resistant)	MIL-G-6032	L-237, Lehigh Chemical Co. Chestertown, Maryland
			Rockwell 950, Rockwell Mfg. Pittsburg, 8 Pa.
			Royco 32, Royal Lubricants Co. Hanover, New Jersey
Deicer, Static, Pitot	Anti-Seize, White Lead Base	TT-A-580	Armite Product, Armite Laboratories, Los Angeles, California
Autopilot (Pipe Threads Only)	Anti-Seize, White Lead Base	JAN-A-669	
Brakes	Hydraulic Fluid or Anti-Seize, White Lead Base	MIL-H-5606 or TT-A-580	

CHART 201 (Cont'd)
THREAD LUBRICANTS

SYSTEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
Air Conditioner	Anti-Seize, Graphite Petrolatum or Anti-Seize, White Lead Base	MIL-T-5544 or TT-A-580	
Oxygen	Tetrafluoroethylene Tape	MIL-T-27730	Johnson and Johnson Inc., Permacel Div., U.S. Highway 1, New Brunswick, New Jersey 08901
Turbocharger Inlet Probe	Anti-Seize Compound	MIL-A-907D	Anti-Seize Compound C5A, Fel-Pro Inc., 7450 McCormick, Skokie, Illinois

CHART 202
CONSUMABLE MATERIALS

Only the basic number of each Military Specification is included in the Consumable Materials Chart. No attempt has been made to update the basic number with the letter suffix that designates the current issues of the various specifications.

Vendors that are listed as meeting the Federal and Military Specifications are provided as reference only and are not specifically recommended by Beech Aircraft Corporation; consequently, any product conforming to the specification listed may be used. The products listed below have been tested and approved for aviation usage by Beech Aircraft Corporation, the vendor, or by compliance with the applicable specifications. Other products that are locally procurable which conform to the requirements of the applicable Military Specification may be used even though not specifically included herein.

It is the responsibility of the operator/user to determine the current revision of the applicable Military Specification prior to usage of that item. This determination may be made by contacting the vendor of a specific item.

ITEM	*MATERIAL*	*SPECIFICATIONS*	*VENDOR PRODUCTS*
1.	Fuel, Engine	100/130 octane (If not available, use 115/145) Never use 91/96 octane fuel.	
2.	Oil, Engine (Ashless Dispersant)	MIL-L-22851	Global Concentrate A Delta Petroleum Company Inc. P.O. Box 10397 New Orleans, La. 70121 Paranox 160 and 165 Enjay Chemical Company 60 West 49th Street New York, N.Y. 10020 RT-451, RM-173E, RM-180E Mobil Oil Corporation 150 East 42nd Street New York, N.Y. 10017

CHART 202 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
2. Oil, Engine (Ashless Dispersent Cont'd.)			Shell Concentrate A Code 60068 Aeroshell W120, Aeroshell W80 Shell Oil Company One Shell Plaza Houston, Texas 77002
			TX-6309 Aircraft Engine Oil, Premium AD120, Premium AD80 Texaco Inc. 135 East 42nd Street New York, N.Y. 10017
			PQ Aviation Lubricant 753 American Oil and Supply Co. 238 Wilson Avenue Newark, N.J. 07105
			Chevron Aero Oil Grade 120 Chevron Oil Co. 1200 State Street Perth Amboy, N.J. 08861
			Esso Aviation Oil E-120, Enco Aviation Oil E-120, Esso Aviation Oil A-100, Enco Aviation Oil A-100, Esso Aviation Oil E-80, Enco Aviation Oil E-80 Exxon Company, U.S.A. P. O. Box 2180 Houston, Texas 77001
			Chevron Aero Oil Grade 120 Standard Oil Co. of Calif. 225 Bush Street San Francisco, Calif. 94120
3.	Corrosion Preventive Compound	MIL-C-6529	Anti-Corrode No. 205, Cities Service Oil Co. 60 Wall Tower, New York 5, N.Y.
			Rust Foil No. 652-2 Franklin Oil and Gas Co. Bedford, Ohio
			Kendex No. 7038, Kendall Refining Co., Bradford, Pa.

CHART 202 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
4.	Lubricating Oil	MIL-L-6081	Gulflite Turbojet Oil No. 1010, Gulf Oil Corp. Pittsburg, Pa. Aeroshell No. 3-1286 Shell Oil Co., 50 West 50th Street, New York, N.Y. 10020 Jet Engine Oil No. 1010 Texaco Inc., 135 East 42nd Street, New York, N.Y. 10017
5.	Lubricating Oil	SAE 20 or SAE 10W30	
6.	Lubricating Oil, Aircraft Reciprocating (Piston) Engine	MIL-L-6082	Conoco Aero Oil No. 1065 Continental Oil Co. Ponca City, Oklahoma Phillips 66 Aviation Engine Oil, Grade 1065 Phillips Petroleum Co. Bartlesville, Oklahoma Skilflite No. 100, Skelly Oil Co., El Dorado, Kansas Avrey 10V1100, Socony Mobil Oil Co. Inc., 150 East 42nd Street New York, N.Y. 10017 Or any approved aircraft engine oil (graded at 1065 or 1100).
7.	Lubricating Oil (Gear)	MIL-L-6086 Grade M	Trojan Gear Oil No. 6086 M. Cities Service Oil Co. 60 Wall Tower, New York 5, N.Y. Aeroshell Fluid 5 M, Shell Oil Co., 50 West 50th Street, New York, N.Y. 10020 L-1195, Sinclair Refining Co., 600 Fifth Avenue, New York, N.Y.

CHART 202 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
8.	Lubricating Grease	MIL-G-7711 (Superseded by MIL-G-81322, see Item 9)	
9.	Lubricating Grease NOTE MIL-G-81322 is not compatible with Aeroshell No. 5 and contains chemicals harmful to painted surfaces.	MIL-G-81322	Mobilgrease 28 Mobil Oil Corporation Shoreham Building Washington, D.C. 20005 Aeroshell Grease 22 Shell Oil Co., 50 West 50th Street, New York, N.Y. 10020
10.	Lubricating Grease (Gear)	Mobile Compound G.G.	
11.	Lubricating Grease (Aircraft and Instruments, Low and High Temperature) NOTE Precautions should be taken when using MIL-G-23827 and MIL-G-81322, since these greases contain chemicals harmful to painted surfaces.	MIL-G-23827	Supermil Grease No. A72832, American Oil Co., 910 South Michigan Avenue Chicago, Ill. 60680 Royco 27A, Royal Lubricants Co., River Road, P.O. Box 95, Hanover, N.J. 07936 Shell 6249 Grease, Shell Oil Co., 50 West 50th Street, New York 20, N.Y.
12.	Lubricant, Molybdenum Disulfide Powder	MIL-M-7866	Molykote Z Wilco Co. Wichita, Kansas Molykote Z Standard Oil of Kentucky Molykote Z, Haskell Engineering and Supply Company 100 East Graham Place Burbank, California 91502 Moly-Paul No. 4, K.S. Paul Products Ltd. Nobel Road, London, England

CHART 202 (Cont'd)
CONSUMABLE MATERIALS

ITEM	*MATERIAL*	*SPECIFICATION*	*VENDOR PRODUCTS*
13.	Hydraulic Fluid	MIL-H-5606	Brayco 756D, Bray Oil Co. 3344 Medford Street Los Angeles 63, California PED 3656, Standard Oil Co. of California, 225 Bush Street, San Francisco 20, California
14.	Oyxgen-System, Leak Testing Compound	MIL-L-25567	
15.	Solvent, Dry Cleaning or White Spirit	PD680 or British Specification 245	
16.	Lubricating Oil	SAE-10	
17.	Air Conditioner Refrigerant	R-12	
18.	Oil (Air Conditioner Compressor) 500 Viscosity		Suniso No. 5, Virginia Chemical and Smelting Co. West Norfolk, Virginia Texaco Capella E, Texaco Inc., 135 East 42nd Street, New York, N.Y. 10017
19.	Aviator's Breathing Oxygen	MIL-O-27210	
20.	Naphtha	TT-N-95	
21.	Methyl Ethyl Ketone	MIL-M-13999	
22.	Toluol (Toluene)	TT-T-548	
23.	Paint Remover		Turco No. 4260, Turco Products Inc., Los Angeles, California
24.	Epoxy Primer		Ameron Industrial Coatings Division, P.O. Box 2153, Wichita, Kansas
25.	Wash Primer	EX2016G	Ameron Industrial Coatings Division, P.O. Box 2153, Wichita, Kansas

CHART 202 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
26.	Zinc Chromate Primer	MIL-P-8585	
27.	Rubber Hose	MIL-H-5593	
28.	Oil, Engine Preservative	MIL-H-5593	
29.	Graphite, Lubricating NOTE Lubricating Graphite Superseded by Item 12	SS-G-659 (Supersedes MIL-G-6711)	
30.	Lubricating Grease	Enco Andok-B	Humble Oil Co. Houston, Texas
31.	Solvent		CRC-2-26, Corrosion Reaction Consultants Limeklim Pike Dresher, Pa.
32.	Laminated Glass Cloth	MIL-F-9084	Trevano, Coast Manufacturing and Supply Inc., Box 71 Livermore, California Uniglass, United Merchants and Manufacturing Inc. 1407 Broadway, New York, New York 10018
33.	Resin	MIL-R-7575	Laminac 4116, American Cyanamid Co., Wallingford, Connecticut Glidpol 1001, The Glidden Company, 925 Euclid Ave. Cleveland, Ohio 44114
34.	Lubricating Grease	Aeroshell 7A	Shell Oil Co., 50 West 50th Street, New York, N.Y.
35.	Urethane Primer		U.S. Paint Lacquer and Chemical Co., 1501 N. Belmont P.O. Box 8151 Wichita, Kansas 67208 Ameron Industrial Coating Division, P.O. Box 2153, Wichita, Kansas

CHART 202 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
36.	Thread Locking Compound	Loctite Sealant, Grade A	Loctite Corp. 705 N. Mountain Road Newington, Conn. 06111
37.	Penetrating Oil	Mouse Milk	Worldwide Aircraft Filters Corp., 1685 Abram Ct. San Leandro, Calif. 94577
		Kano Kroil	Kano Labratories Inc. Nashville, Tennessee
38.	Lubricating Grease	MIL-G-3545	Aeroshell Grease 5 Shell Oil Co., 50 West 50th Street, New York, N.Y.
39.	Cement	EC2262	Minnesota Mining and Manufacturing Company St. Paul, Minnesota
40.	Primer	Locquic "N"	Loctite Corp. 705 N. Mountain Road Newington, Conn. 06111
41.	Cleaner	Turco Metal-glo No. 3	Turco Products Inc. 24600 S. Main Los Anglels, California 90746
42.	Paint Stripper	Turco 4260	Turco Products Inc. 26400 S. Main Los Angeles, California 90746
43.	Corrosion Preventive Compound	MIL-C-16173 Grade 2	Braycote 137, Bray Oil Co. 1925 N. Marianna Ave. Los Angeles, California 90032
			Petrotech 1-4 Pamreco, P.O. Box 671, Butler, Pa. 16001
44.	Lubricating Grease	MIL-G-7118	
45.	Primer, Degreasing	EC3911	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
46.	Lubricating Silicone	G-322L	General Electric Waterford, New York 12188
47.	Anti-Seize Compound	Locatite 76764 Paste Form 1 lb. Brush Top Can	Loctite Corp. 705 N. Mountain Road Newington, Conn. 06111
48.	Coating	Alodine 1200, 1200S or 1201	Amchem Products Inc. Spring Garden Street Ambler, Pennsylvania

CHART 203
SERVICING

ITEM	*LOCATION*	*SERVICE WITH*	*INTERVAL*
CHECK			
Engine Oil Level	Access door on upper cowling (2)	MIL-L-22851	Preflight
Battery Electrolyte	Access plate on LH rear nacelle (1)	See Chapter 24 for detailed instructions	Every 100 hrs.
Air Conditioner Compressor Oil Level	See Chapter 21 for location and special instructions	Suniso No. 5 or Texaco Capella E, 500 Viscosity oil	As Required
Air Conditioner Refrigerant	See Chapter 21 for location and special instructions.	Refrigerant No. 12	As Required
Propeller Air Dome	Access cap on propeller spinner (2)	Dry air or nitrogen	Every 100 hrs.
Propeller Accumulator	Lower rear of engine (2)	Dry air or nitrogen	Every 100 hrs.
Differential Control Valve and Safety Valve (P-4 thru P-307)	Aft pressure bulkhead	Refer to Chapter 21-30-00	Every 100 hrs. or Annually
Outflow and Safety Valve (P-308 and After)	Aft pressure bulkhead	Refer to Chapter 21-30-00	Perform Functional Test Every 500 Hours
CHANGE			
Engine Oil	Access plate on lower nacelle (2)	MIL-L-22851	Every 75 - 100 hrs.
Engine Oil Filter	RH side of engine (2)		Every 50 hrs.
CLEAN			
Air Pump Intake Filter	Forward side of aft engine baffle (2) (P-3 through P-246)	Wash with soap and water, rinse and dry	Every 100 hrs.
Induction Air Filter	RH rear side of engine (2)	Clean per instructions on filter	Every 50 hrs.
Servo Fuel Filter	Fuel injection (2)	Clean with solvent and blow dry with air pressure.	Every 100 hrs.
Manual Cabin Altitude Control Filter (P-3 thru P-307)	RH subpanel (1)	Clean with solvent and blow dry with air pressure.	Every 100 hrs.
Cabin Pressurization Controller Filter and Orifice (P-308 and after)	RH Subpanel (1)	Remove filter, disassemble, clean with solvent and air dry. Ensure orifice is open, reassemble and reinstall.	Every 500 hrs.

CHART 203 (Cont'd)
SERVICING

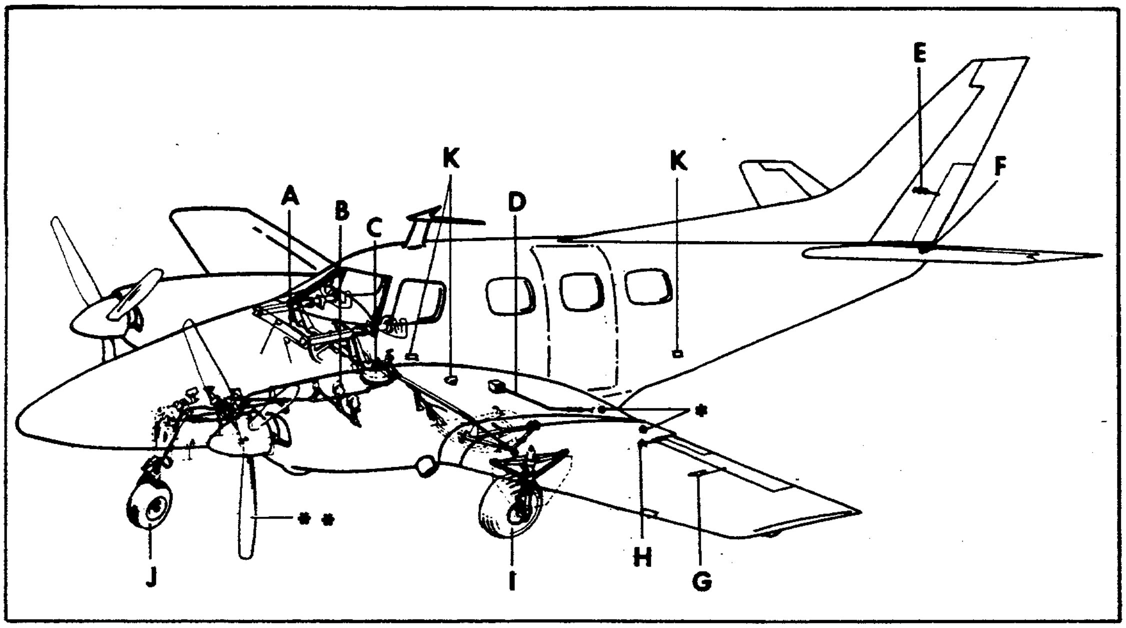
ITEM	*LOCATION*	*SERVICE WITH*	*INTERVAL*
CLEAN (Cont'd)			
Cabin Pressurization Safety Valve Filter and Orifice (P-308 and after)	Aft Pressure Bulkhead (1)	Remove filter, disassemble, clean with solvent and air dry. Ensure orifice is open, reassemble and reinstall.	Every 1000 hrs.
Static Air Button	Aft fuselage skin (4)	Clean with solvent and wipe dry with clean rag.	Every 100 hrs.
Engine Oil Screen	Engine oil sump (2)	Clean with solvent and blow dry with air pressure.	At Oil Change.
Heater Fuel-Supply Strainer	LH wing stub (1)	Clean with solvent and blow dry with air pressure.	Every 100 hrs. of heater operation.
Heater Fuel Pump Filter	LH wing stub (1)	Clean with solvent and blow dry with air pressure.	Every 100 hrs. of heater operation.
Heater Inline Fuel Filter	Nose Wheel Well (1)	Clean with solvent and blow dry with air pressure.	Every 100 hrs. of heater operation.
DRAIN			
Fuel Sump Drain	Lower wing surface (2)		Preflight
Fuel Strainer Drain	Lower wing surface (2)		Preflight
Fuel Tank Drain	Lower wing surface (2)		Preflight
Heater Fuel Drain	Aft bulkhead of nose wheel well		Preflight
Static Drain	On upholstery panel below copilot's subpanel (1)		Every 100 hrs.
REPLACE			
Pressure System Inline Air Filter	RH rear side of nacelle (2) (P-3 through P-159, except P-158)		Every 150 hrs.
Pressure System Inline Air Filter	RH rear side of nacelle (2) (P-158, P-160 and after)		Every 300 hrs.
Air Pump Intake Filter	Forward side of aft engine baffle (P-247 and after)		Every 300-500 hrs.
Induction Air Filter	RH rear side of each engine (2)		Every 500 hrs.
Motorized Cabin Altitude Controller Filter	Mounted on controller behind RH subpanel		Every 1000 hrs.
Electric Trim Tab Actuator Motor Brushes	Aft fuselage		Every 1000 hrs.

CHART 203 (Cont'd)
SERVICING

ITEM	*LOCATION*	*SERVICE WITH*	*INTERVA*
REPLACE (Cont'd)			
Emergency Locator Transmitter (ELT) Battery	Aft fuselage		One half of battery service life or when in use for one cumulative hour, or after inadvertant activation of unknown duration.
SERVICE			
Brake Fluid Reservoir	Forward baggage compartment (1)	MIL-H-5606 hydraulic fluid	As Required
Oxygen Cylinder	Forward baggage compartment (1)	MIL-O-27210, aviators breathing oxygen	As Required
Main and Nose Landing Gear Struts	Top of each strut (3)	MIL-H-5606, hydraulic fluid and compressed air.	Every 100 hrs.

( ) Indicates number of points to be serviced.

CHART 204
LUBRICATION SCHEDULE



NOTE

Apply MIL-G-81322 lubricating grease at all points of friction in the cabin door except where Oilite bearings are installed. The time interval for lubrication is as required.

Precaution should be taken when using MIL-G-23827 and MIL-G-81322, since these greases contain chemicals harmful to painted surfaces.

* Flaps track rollers (pre-lubed sealed bearings). Pressure lubricate at 1000 hours inspection using MIL-G-23827 lubricating grease.

** MIL-G-23827 grease is recommended for use in lubricating the blade bearings in the Hartzell Propeller. This grease will insure against a possible freeze up of the pitch change mechanism when prolonged flights are made at altitudes where the ambient temperature is below -20°C. Lubricate at 100 hours inspection. (6)

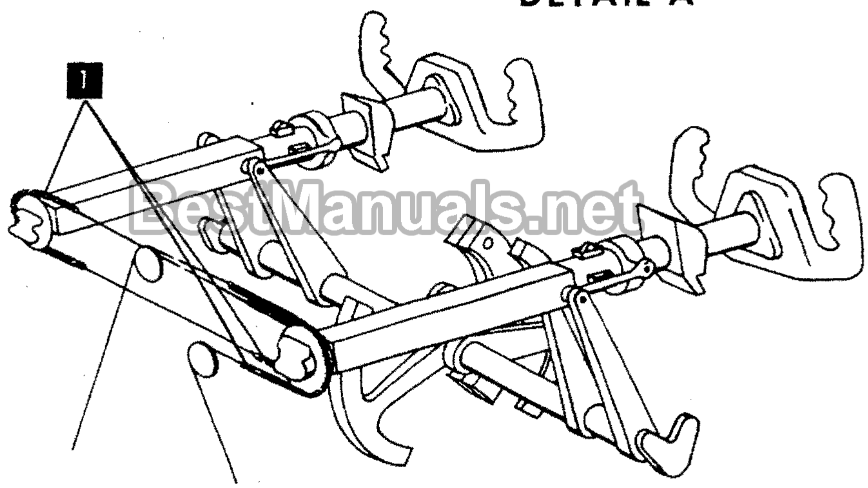
( ) Indicates the number of points to be lubricated.

A60-604-7B

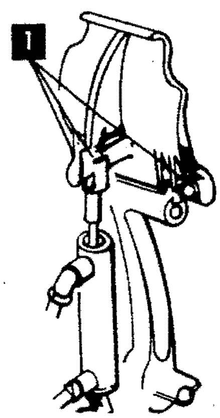
CHART 204 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	LUBRICANT	INTERVAL
	CONTROL COLUMN	DETAIL A	
1	Control column chain (3)	SAE-20	100 hrs.

DETAIL A



DETAIL B



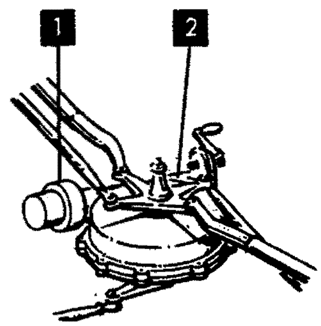
INDEX	LOCATION	LUBRICANT	INTERVAL
	RUDDER PEDALS	DETAIL B	
1	Pedals linkage (6)	SAE-20	100 hrs.

A60-604-8A

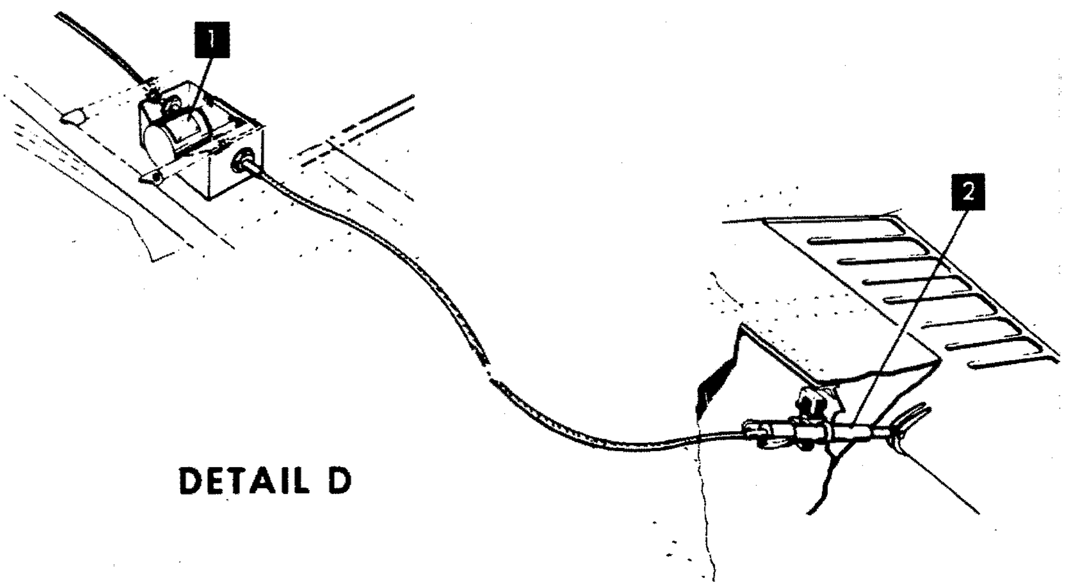
CHART 204 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	LUBRICANT	INTERVAL
	LANDING GEAR ACTUATOR	DETAIL C	
1	Landing gear motor gear box (1)	MIL-G-81322	300 hrs.
2	† Landing gear actuator gear box (1)	Mobile Compound GG	300 hrs.

DETAIL C



† When properly filled, the oil level on a dip stick inserted through the filler hole will be approximately ¼ inch.



DETAIL D

INDEX	LOCATION	LUBRICANT	INTERVAL
	FLAP ACTUATOR	DETAIL D	
1	Flap motor gear box (1)	MIL-G-23827	300 hrs.
2	Flap actuator (2)	MIL-L-6086 Grade M	1000 hrs.

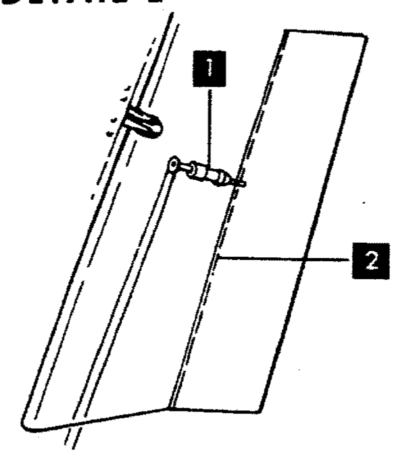
A60-604-98

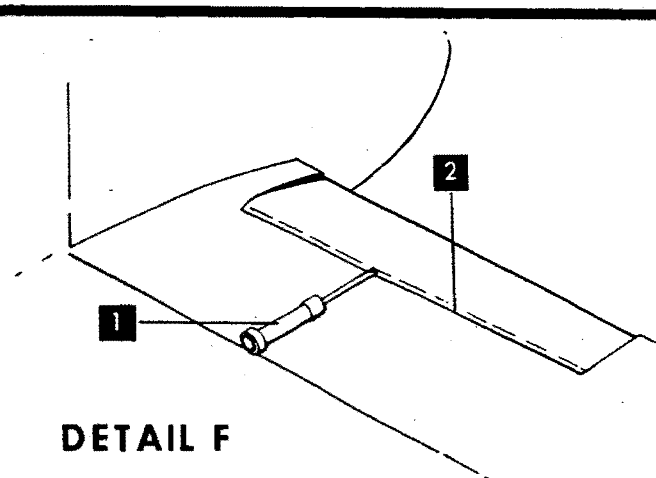
CHART 204 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	LUBRICANT	INTERVAL
	RUDDER TRIM	DETAIL E	
1	Rudder trim tab actuator (1)	MIL-G-23827	AR
2	†Rudder trim tab hinge (1)	MIL-M-7866	100 hrs.

† Mix MIL-M-7866 with naptha and apply with a brush

DETAIL E





DETAIL F

INDEX	LOCATION	LUBRICANT	INTERVAL
	ELEVATOR TRIM	DETAIL F	
1	Elevator trim tab actuator (1)	MIL-G-23827	AR
2	†Elevator trim tab hinge (1)	MIL-M-7866	100 hrs.

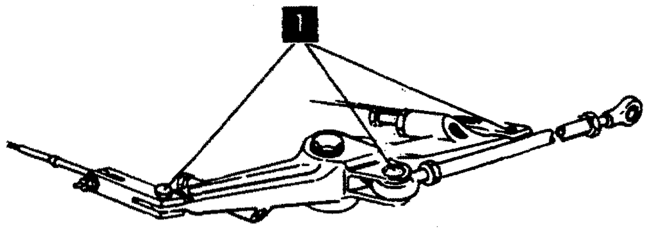
†Mix MIL-M-7866 with Naphtha and apply with a brush.

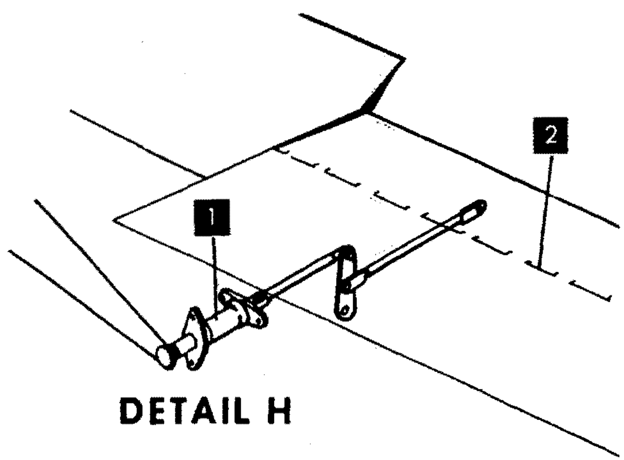
A60-604-10B

CHART 204 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	LUBRICANT	INTERVAL
	AILERON BELL CRANK	DETAIL G	
1	Aileron bell crank (6)	SAE10W-30	100 hrs.

DETAIL G





DETAIL H

INDEX	LOCATION	LUBRICANT	INTERVAL
	AILERON TRIM TAB	DETAIL H	
1	Aileron trim tab actuator (1)	MIL-G-23827	AR
2	†Aileron trim tab hinge (1)	MIL-M-7866	100 hrs.

†Mix MIL-M-7866 with naphtha and apply with a brush

A60-604-11B

CHART 204 (Cont'd)
LUBRICATION SCHEDULE

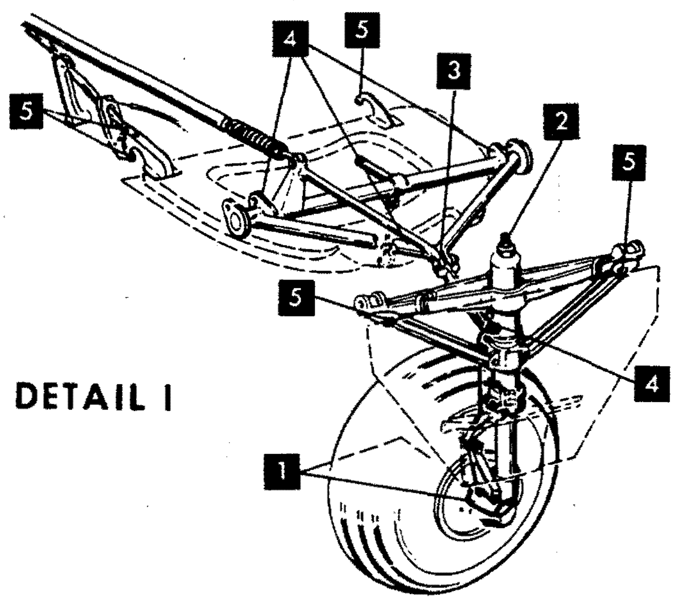
INDEX	LOCATION	LUBRICATION	INTERVAL
	MAIN LANDING GEAR	DETAIL I	
1	Main wheel bearings (4)	MIL-G-3545	100 hrs.
2	Main shock struts (2)	MIL-H-5606	100 hrs.
3	Uplock rollers (2)	*SAE10W-30 HAND PACK WITH MIL-G-23827	50 hrs. 100 hrs.
		**MIL-G-23827	100 hrs.

*P-3 THRU P-154, P-156 THRU P-162, P-167 THRU P-171 AND P-182, PRIOR TO COMPLIANCE WITH S.I. 0482-211.

**P-155, P-163 THRU P-166, P-172 THRU P-181, P-183 AND AFTER, AND PREVIOUS AIRPLANE SERIALS IN COMPLIANCE WITH S.I. 0482-211.

NOTE

Refer to Chapter 32 of the Maintenance Manual for instructions on periodic lubrication of uplock rollers.



DETAIL I

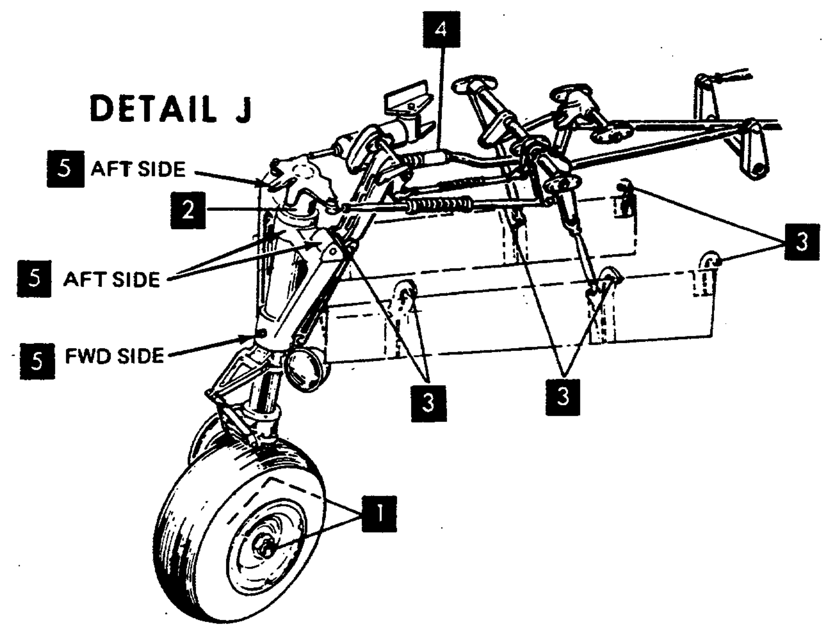
INDEX	LOCATION	LUBRICANT	INTERVAL
4	Main retract fittings (8)	MIL-G-81322	100 hrs.
5	Main gear door hinges (10)	SAE10W-30	100 hrs.

A60-604-15

CHART 204 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	LUBRICANT	INTERVAL
	NOSE LANDING GEAR	DETAIL J	
1	Nose wheel bearings (2)	MIL-G-3545	100 hrs.
2	Nose shock strut (1)	MIL-H-5606	100 hrs.
3	Nose gear door hinges (6)	SAE10W-30	100 hrs.
4	Nose gear forward retract rod (1)	MIL-G-7118	600 hrs.
*5	Nose gear brace bushings (4)	MIL-G-81322	100 hrs.

*P-297 and after

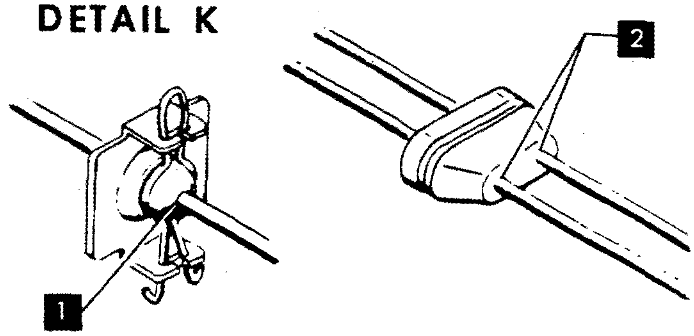


A60-604-13B

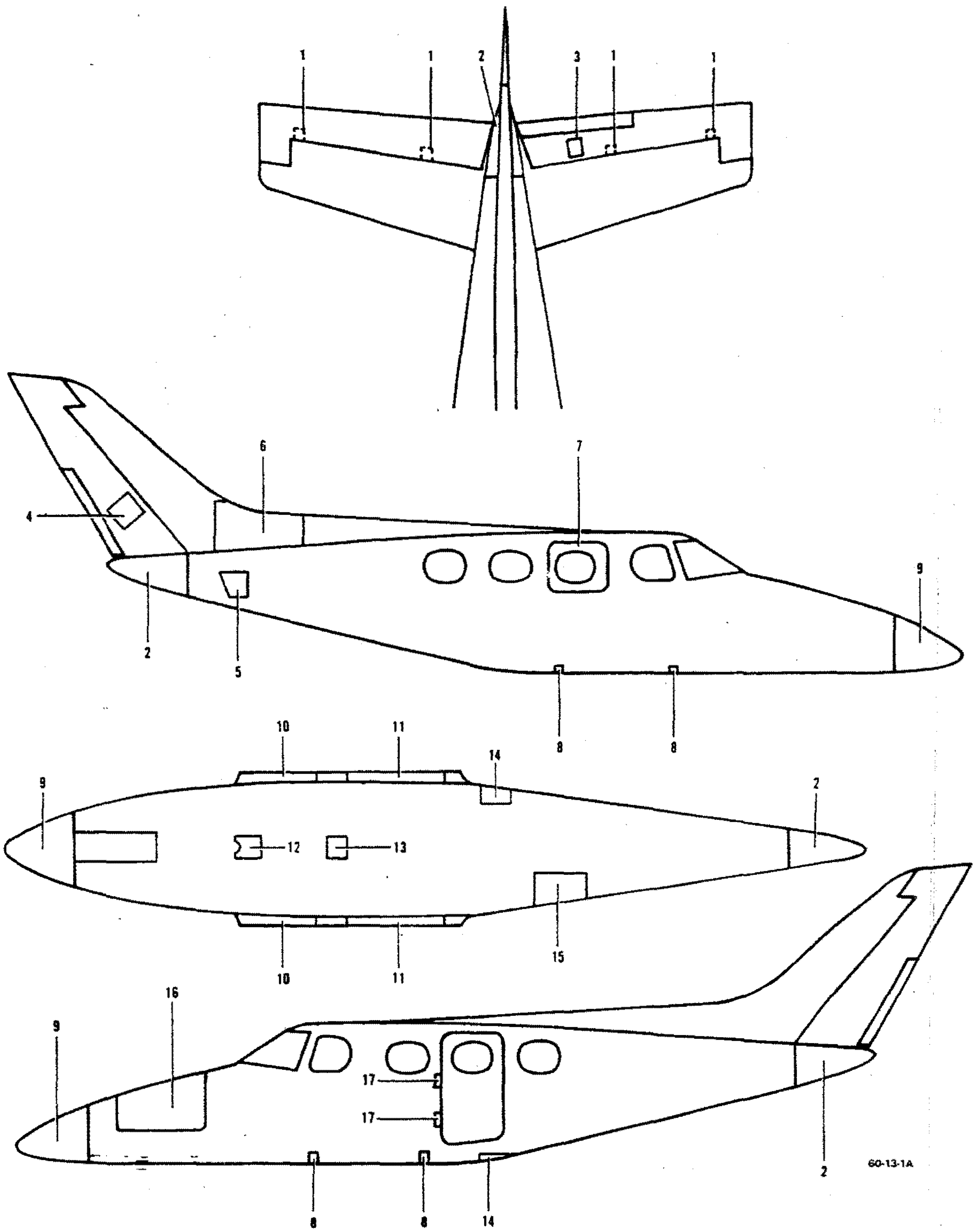
CHART 204 (Cont'd)
LUBRICATION SCHEDULE

INDEX	LOCATION	LUBRICANT	INTERVAL
	CABLE PRESSURE SEALS	DETAIL K	
1	Control cable pressure seals (8)	MIL-G-23827	1000 hrs.
2	Trim tab cable pressure seals (3)	MIL-G-23827	1000 hrs.

DETAIL K



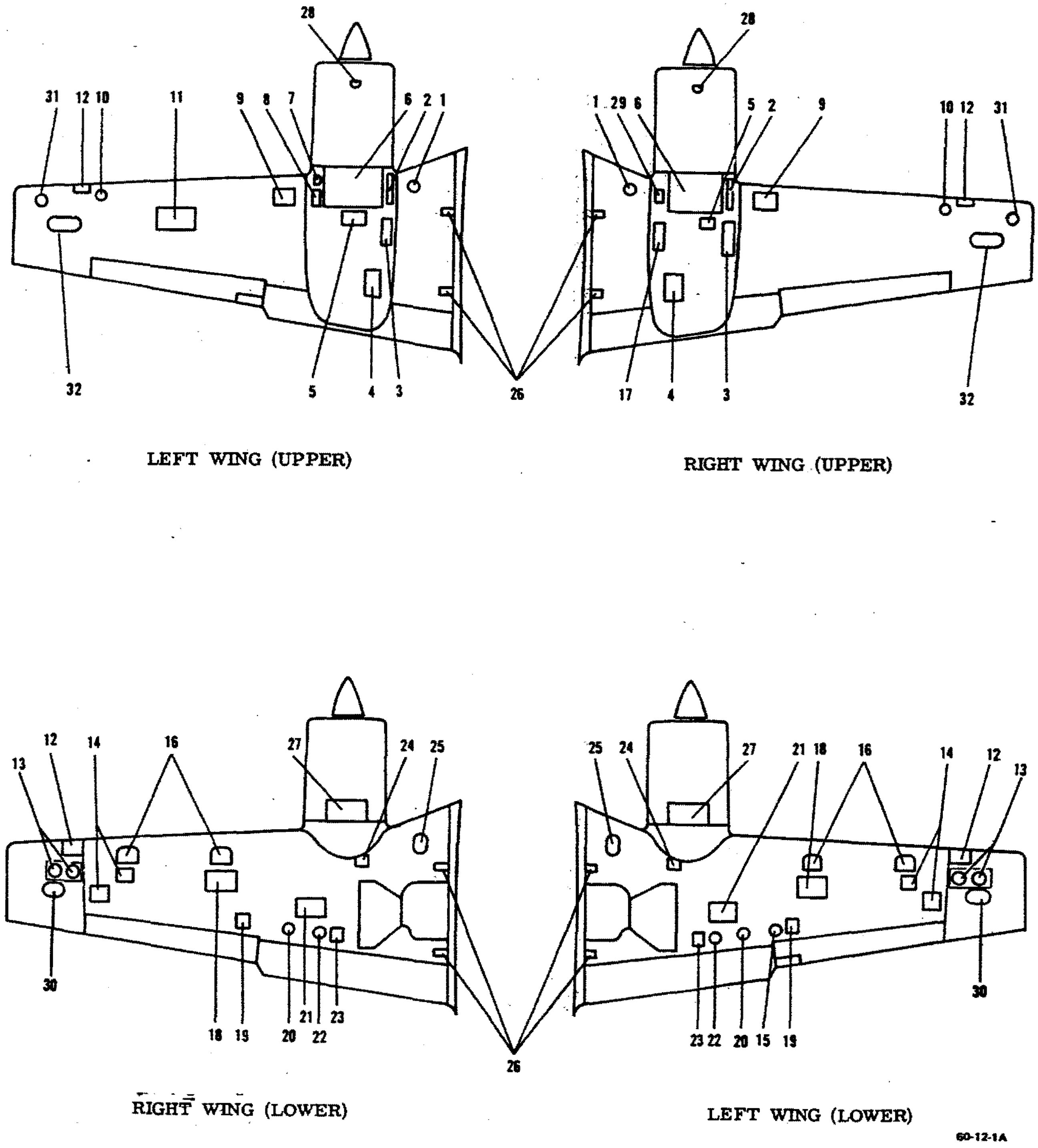
A60-604-14A



Fuselage Access Openings (Sheet 1 of 2)
Figure 203

1. Elevator Hinges
2. Tail Cone
3. Elevator Trim Tab Actuator
4. Rudder Trim Tab Actuator
5. Deicer Dump Valve, Elevator Bell Crank, Rudder Bell Crank and Control Cables
6. Vertical Stabilizer Deicer Hose
7. Emergency Exit
8. Wing Bolts
9. Nose Cone
10. Intercooler
11. Uplock Cable, Retract Rods, Retract Rod Pressure Seals and Wing Stub Fuel Fittings
12. Lower Pedestal
13. Landing Gear, Gearbox and Actuator
14. Assist Step Mechanism
15. Autopilot Aileron, Rudder and Elevator Servos, Magnetic Navigation Sensing Element (B-5P Autopilot) and Autopilot Computer (H-14 Autopilot)
16. Oxygen Filler and Bottle, Heater, Ram Air Plenum, Brake Fluid Reservoir, Avionics Equipment and Baggage Compartment
17. Cabin Door Hinges

Fuselage Access Openings (Sheet 2 of 2)
Figure 203

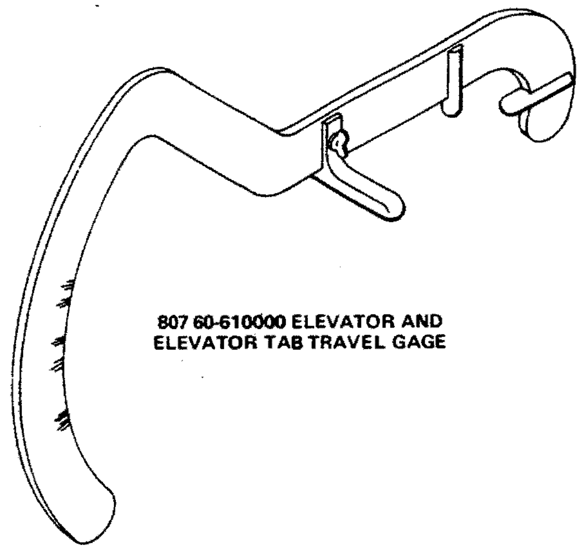


Wing Access Openings
Figure 204 (Sheet 1 of 2)

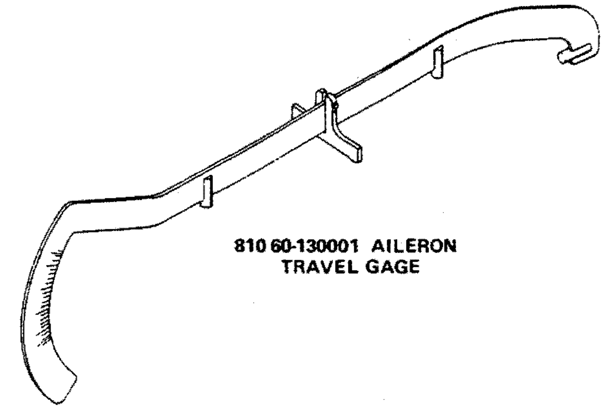
1. Leading Edge Fuel Cell Transmitter
2. Alternate Air and Fuel Pressure Solenoid
3. Nacelle Fuel Cell Transmitter and Plumbing
4. Nacelle Fuel Cell and Vent Line Plumbing
5. Fuel Vent Check Valve and Plumbing
6. Battery, Battery Relays, Voltage Regulators, Overvoltage Relays, Starter Relays, Paralleling Rheostat, Fuel Flow Inverter, Loadmeter Shunt, Fuse Block, Radio Inverter, Radio Inverter Circuit Breaker and Relay, External Power Diode and Current Limiter for Battery
7. External Power Receptacle
8. Reverse Current Diode, External Power and LH Control Relay
9. Leading Edge Fuel Cell Transmitter and Fuel Cell Installation
10. Fuel Filler
11. Remote Compass
12. ** Landing Light
13. * Wing Tip Wiring and Fuel Vent Float Valve
14. Fuel Siphon Valve
15. Aileron Tab Actuator
16. Leading Edge Fuel Cell
17. Nacelle Fuel Cell Plumbing
18. Box Section Fuel Cell
19. Aileron Actuator and Pulley
20. Aileron Cable, Fuel Vent and Battery Vent
21. Box Section Fuel Cell
22. Fuel Vent Line and Aileron Tab Cable
23. Fuel Vent Line
24. Landing Gear Attach Bolt
25. Fuel Boost Pump
26. Wing Attach Bolt
27. Cowl Flap
28. Oil Level Indicator
29. Reverse Current Diode
30. ** Remote Compass Detector
31. † Fuel Filler
32. † Wing Tip Access Openings

One rectangular opening on P-223 through P-347, P-349 through P-364
P-223 through P-347, P-349 through P-364
Optional P-348, P-365 and after

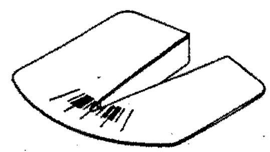
Wing Acess Openings (Sheet 2 of 2)
Figure 204



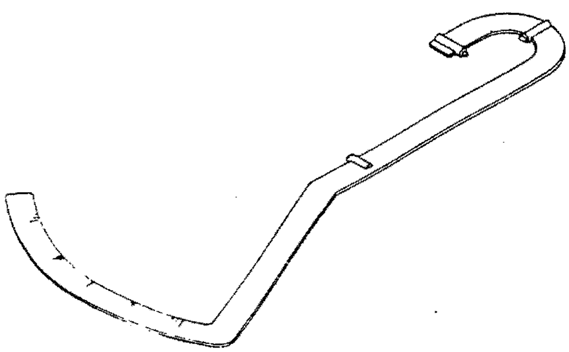
807 60-610000 ELEVATOR AND
ELEVATOR TAB TRAVEL GAGE



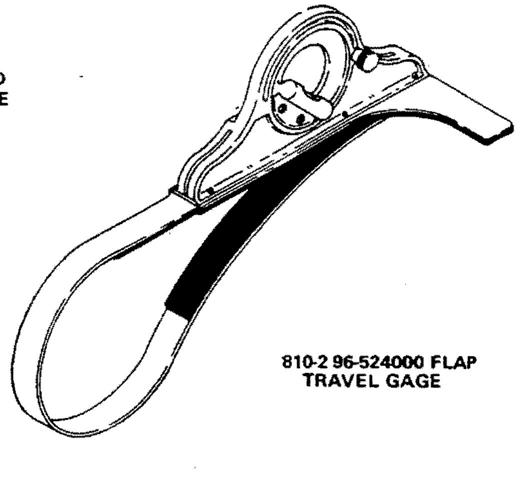
810 60-130001 AILERON
TRAVEL GAGE



810-1 60-130001 AILERON TAB
TRAVEL GAGE



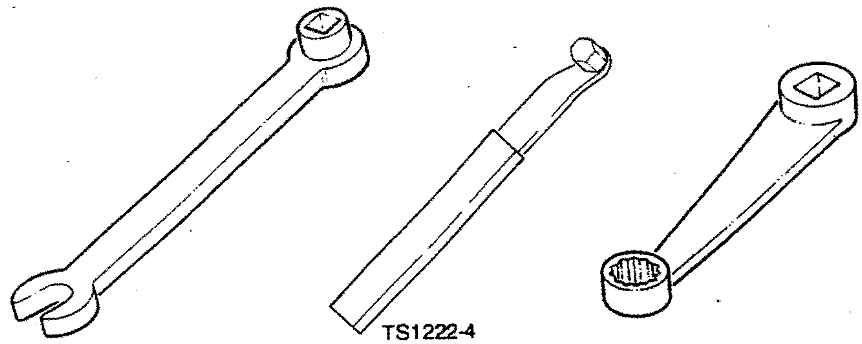
807 60-630001 RUDDER AND
RUDDER TAB TRAVEL GAGE



810-2 96-524000 FLAP
TRAVEL GAGE

60-17-4

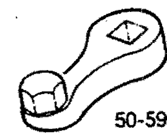
Special Tools (Sheet 1 of 3)
Figure 205



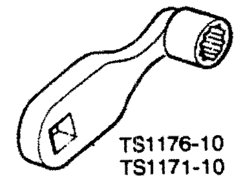
922 60-960000 PROPELLER
TORQUE WRENCH ADAPTER

TS1222-4
TS1222-8

50-590014



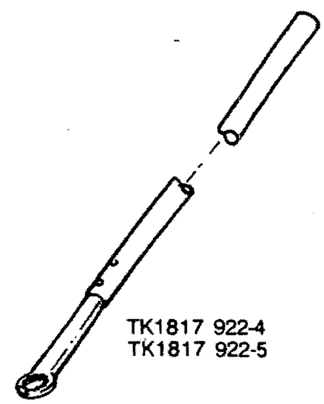
50-590013
TS1171-1
TS1176-1
TS1176-2
TS1171-2



TS1176-10
TS1171-10

WING BOLT WRENCHES

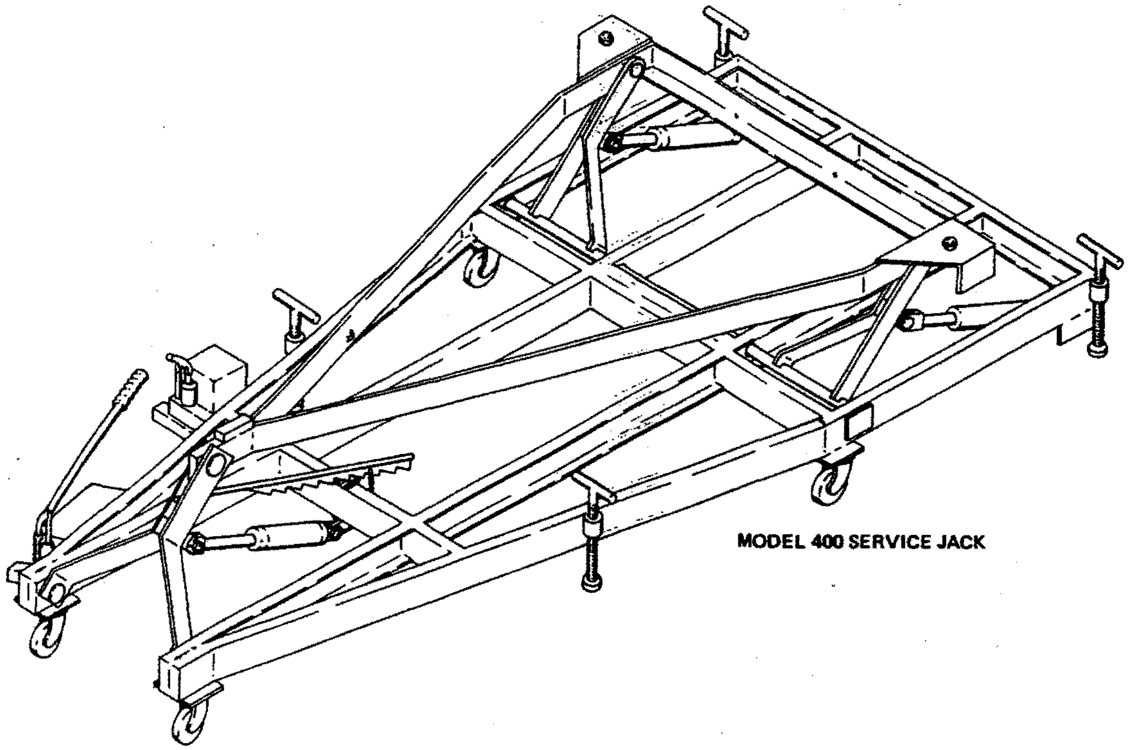
TK1817 922-4	UPPER FORWARD WING BOLT WRENCH.
TS1171-2 or TS1176-2	UPPER FORWARD WING NUT TORQUE WRENCH ADAPTER (for internal wrenching nut).
TS1171-10 or TS1176-10	UPPER FORWARD WING NUT TORQUE WRENCH ADAPTER (for external wrenching nut).
TK1817 922-5	LOWER FORWARD WING BOLT WRENCH.
50-590014	LOWER FORWARD WING NUT TORQUE WRENCH ADAPTER.
TS1222-4 or TS1222-8	UPPER AFT WING BOLT WRENCH.
TS1171-1 or TS1176-1 or 50-590013	UPPER AFT WING NUT TORQUE WRENCH ADAPTER.
TK1817 922-4	LOWER AFT WING BOLT WRENCH.
TS1171-2 or TS1176-2	LOWER AFT WING NUT TORQUE WRENCH ADAPTER (for internal wrenching nut).
TS1171-10 or TS1176-10	LOWER AFT WING NUT TORQUE WRENCH ADAPTER (for external wrenching nut).

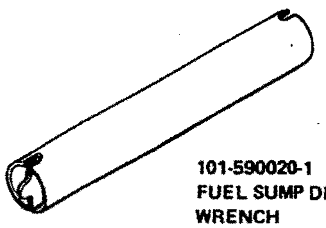


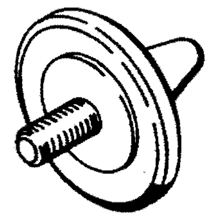
TK1817 922-4
TK1817 922-5

60-17-7

Special Tools (Sheet 2 of 3)
Figure 205







60-17-8A

Special Tools (Sheet 3 of 3)
Figure 205

"END"

CHAPTER 20

LIST OF PAGE EFFECTIVITY

"END"

CHAPTER 20 - STANDARD PRACTICES - AIRFRAME

TABLE OF CONTENTS

"END"

STANDARD PRACTICES - AIRFRAME

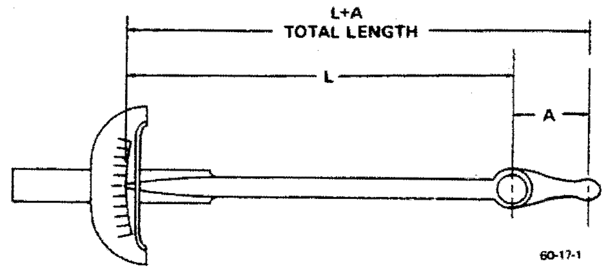
TORQUE WRENCHES

When a torque wrench and adapter is used, (Figure 201) compensation must be made for the extra leverage gained. New indicator readings must be calculated before the wrench is used. To figure the desired lower readings which will actually give the torques specified, use the following formula:

$$\frac{\text{Original wrench length x specified torque}}{\text{length of wrench + adapter}} = \text{Desired reading}$$

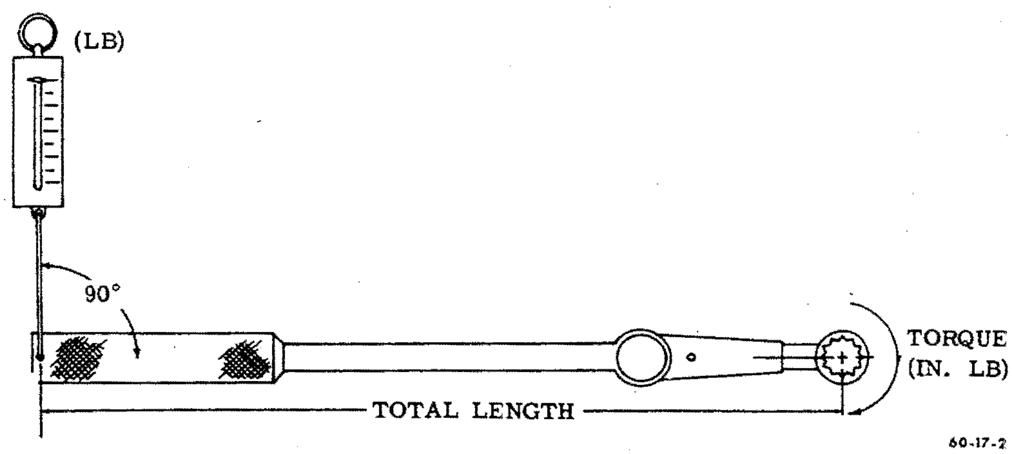
Example:	D	=	Desired reading
	L	=	Length of torque wrench
	A	=	Adapter length
	T	=	Torque
	D	=	?
	L	=	33 inches
	A	=	11 inches
	T	=	5,000 inch-pounds

$$\frac{33 \times 5{,}000}{33 + 11} = \frac{165{,}000}{44} = 3{,}750 \text{ inch-pounds}$$



Torque Wrench and Adapter
Figure 201

An acceptable method of checking the torque if a torque wrench is not available (Figure 202), is to attach a spring scale to a conventional flex or "T" handle inserted in an adapter. Force should be applied in a direction perpendicular to an imaginary line extending from the center of the bolt through the spring scale attaching point.



Computing Torque with Spring Scale
Figure 202

To calculate the force in pounds (scale reading) required to obtain the specified torque, divide the torque in inch-pounds by the distance in inches between the center of the bolt and the scale attaching point. For example, if the specified torque is 5,000 inch-pounds and the distance is 25 inches, a pull of 200 pounds must be applied. Unless torque values are specified as wet (lubricated), bolts to be torqued must be clean and free of all lubricants; otherwise loss of normal friction allowed for establishing the torque values may result in overtorquing of the bolt.

When a torque wrench adapter is used, the length of the adapter must be added to the length of the flex or "T" handle wrench and a value calculated for that particular combination. The following is a typical example in finding a desired value.

Effective length of flex or "T" handle wrench	12 inches
Length of adapter	3 inches
Total length	15 inches
Desired torque on bolt	2,000 inch-pounds

$$\frac{2{,}000 \text{ inch-pounds}}{15 \text{ inches}} = 133.3 \text{ pounds (scale reading)}$$

AIRPLANE FINISH CARE

CLEANING AND WAXING THE AIRPLANE FINISH

NOTE

Urethane finishes are fully cured at time of delivery, may be cleaned with detergents and require no waxing.

Enamel finishes will maintain the original beauty for many years if a few timely suggestions are followed. To preserve this finish, the following care is recommended:

DURING CURING PERIOD (90 days)

a. The airplane should be cleaned with cold or lukewarm water and a mild nondetergent soap. Any rubbing of the painted surfaces should be done gently and held to a minimum to avoid cracking of the paint film. Rinse with cold water and dry with cloths or chamois.

b. Avoid use of waxes or polish. They seal the paint from the air and delay the curing process.

c. Do not rub or buff the finish.

d. Flights through rain, hail or sleet should be avoided.

e. Avoid fluids containing dyes, such as fuel and hydraulic oil, being accidentally spilled on the painted surfaces.

AFTER CURING PERIOD

a. Always wash the airplane with a mild soap : water. Rinse thoroughly.

b. Remove oil and grease with naphtha.

c. Wax with any good grade of automobile wax i shaded area. A heavier coating of wax on the leading ed will help to reduce abrasions in those areas. (Urethane p requires no waxing.)

d. Never use strong detergents to clean the airpla

NOTE

Frequently inspect the underside of the wing and flaps in the area covered by the engine turbocharger exhaust stream for fuel lead deposits. If such deposits are discovered, they should be removed immediately with a water and mild detergent solution and the surface rewaxed.

EXTERIOR AND INTERIOR FINISHES

NOTE

Any time an airplane is repainted or touched up, inspect all placards to ensure that they are not covered with paint, are legible and are securely attached.

The following list is included to be used as a refere should it become necessary to touch up or match an inte or exterior paint. Each paint is listed according to spe type and whether an exterior or interior paint.

EXTERIOR AND INTERIOR PRIMERS

Interior (Aluminum)	MIL-P-8585
Interior (Magnesium)	Enmar EX1479
Exterior (Aluminum)	Enmar EX2016G or MIL-P-8585
Exterior (Magnesium)	Enmar Epoxy Primer
Urethane Acid Etch Wash (Exterior Surface)	Enmar EX2016G Ba Enmar T6070 Catal
Urethane Intermediate Coat (Exterior Surface)	U.S. Paint 6165 Ba U.S. Paint AA-92-C- Catalyst

ENAMEL

(Exterior Colors)

Pacific Blue	118684-1
Morning Glory Blue	118684-3
Blueberry Blue	118684-5
Surf Green	118684-7
Shamrock Green	118684-9
Turquoise	118684-11
San Mateo Wheat	118684-13
Lemon Yellow	118684-15
Saturn Gold	118684-17
Castle Tan	118684-19
Beaver Brown	118684-21
Flamingo	118684-23
Huntsman Red	118684-25
Toreador Red	118684-27
Chianti Red	118684-29
Matterhorn White	118684-31
Black	118684-33
Champagne Gold	118684-39
Jubilee Gold	118684-221
Sable Brown	118684-223
Sunshine Yellow	118684-231
Capri Blue	118684-265
Omaha Orange	118684-273
Kingston Gray	118684-299
Peacock Turquoise	118684-333
Terrace Blue	118684-335
Sahara Tan	118684-337
Prairie Beige	118684-339
Antique Gold	118684-341
Beachwood	118684-345
Embassy Red	118684-347
Marlin Blue	118684-349
Bahama Blue	118684-351
Pavonne Blue	118684-353
Matador Red	118684-355
Sunburst Yellow	118684-357
Jade Mist Green	118684-359
Astro Blue	118684-361

URETHANE

(Exterior Colors)

Jubilee Gold	118684-302
Morning Glory Blue	118684-304
Blueberry Blue	118684-305
Surf Green	118684-306
Shamrock Green	118684-307
Turquoise	118684-308
Lemon Yellow	118684-310
Castle Tan	118684-312
Huntsman Red	118684-315
Toreador Red	118684-316
Chianti Red	118684-317
Matterhorn White	118684-318
Black	118684-319
Sable Brown	118684-320
Capri Blue	118684-322
Champagne Gold	118684-323
Omaha Orange	118684-324
Kingston Gray	118684-325
Marlin Blue	118684-393
Bahama Blue	118684-395
Pavonne Blue	118684-397
Matador Red	118684-399
Sunburst Yellow	118684-401
Jade Mist Green	118684-403
Astro Blue	118684-405
Peacock Turquoise	118684-407
Terrace Blue	118684-409
Sahara Tan	118684-411
Prairie Beige	118684-413
Antique Gold	118684-415
Beechwood	118684-419
Embassy Red	118684-421

LACQUER

(Interior Colors)

Alpine Blue	118684-63
Anchor Gray	118684-75
Dull Black	118684-133
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ENAMEL

(Interior Colors)

Insignia Red	94-509
Black	94-515
Instrument Black	Color No. 514 per ANA Bulletin No. 157

Short cut masking jobs for your paint department are possible when you use pre-cut paint patterns and numbers. Stripe and numeral patterns are available from Mid-America Marking Inc., 1720 S. 151 W., Wichita, Kansas 67052, or any other equivalent product may be used. Current listings include 4, 12, and 20 inch Call Numbers and Letters. Time can be saved when using these patterns and a much neater final paint job can be expected.

PAINTING ALUMINUM

ENAMEL PAINT

PREPARATION OF AIRPLANE ALUMINUM EXTERIOR FOR PAINT

a. Mask windows with a double thickness of paper. Cover all openings where paint might enter airplane.

b. Sand scratches and rough areas to improve smoothness.

c. Clean surface of airplane with solvent, (lacquer thinner or methyl ethyl ketone), to remove shop primer, exposed sealer, and other shop soils.

d. Lightly roughen all scratches with nylon pad to insure a satisfactory paint base.

e. Reclean the roughened surface with solvents to ensure removal of all hand prints and dirt.

APPLICATION OF EXTERIOR PAINT ON ALUMINUM SKINS

a. Prime surfaces with wash primer (25, Chart 207, 91-00-00). Mix only enough primer for use within an eight hour priod. Primer mixed longer than eight hours must be discarded.

b. Apply one coat of wash primer. Keep air pressure at a minimum to prevent overspray.

NOTE

Temperature and humidity will effect drying time of the primer. It should dry at least 15 minutes before recoating the surface (test surface with light fingernail pressure).

c. Proceed to prime with a wet coat of MIL-P-8585 zinc chromate primer (26, Chart 207, 91-00-00) thinned one part primer and two parts toluol. A heavy hiding coat of this primer is not desired and will impair performance.

d. The exterior surfaces are now ready for color coat.

e. Spray on two thin topcoats of enamel.

EXTERIOR PAINT TOUCH-UP REPAIR (ENAMEL)

a. Mask around the skin containing the damaged area.

b. Remove any loose edges of paint by using a high tack adhesive tape around the edge of the damaged area.

c. Using a coarse sandpaper, fair the edge of the damaged area with the metal.

d. When the edge of the paint begins to "feather" into a smooth joint, use a fine grade of sandpaper to eliminate the sand scratches left by the coarse paper so that the finish will be perfectly smooth. Take care to avoid removing any more metal then is absolutely necessary.

e. Wash the sanded area with a solvent, such as naphtha or toluol. Change the wash cloths used for this purpose frequently so that all the sanding dust will be picked up.

f. After the area to be touched up has been cleaned with solvent until all trace of discoloration is gone, apply a thin coat of pretreatment primer to the damaged area.

g. Spray two or three coats of the zinc chromate primer for a heavier than normal build-up.

h. After the primer has dried, sand the area being repaired with a medium fine sandpaper. Sand the edge of the repair area until the indentation where the metal and the old paint meet is gone. If it is necessary, apply additional primer until the junction of the paint and metal is no longer visible.

i. Spray on two thin topcoats of finish paint.

URETHANE PAINT

The need for an extremely hard finish for protection against sandblast during takeoff and landings led to the development of urethane coatings for airplanes. Urethane paint dries into a high gloss and retains color much better than standard finishes. It is unaffected by the chemicals in hydraulic fluids, deicer fluids and fuels and requires less care and maintenance than other finishes.

URETHANE PAINT REPAIR PROCEDURES

NOTE

The time normally required for urethane paint to cure must be extended at temperatures below 70°F. The paint will not cure at temperatures below 60°F.

Dukes painted with urethane paints are finished with pretreatment (wash) primer, urethane primer and a topcoat of urethane enamel. The following procedures include cleaning, paint stripping, repaint preparation, priming, applying a urethane topcoat and an alternate method for small repairs not requiring paint stripping. Careful observation of these procedures should result in a smooth, hard, glossy finish with firm adhesion for maximum life.

STRIPPING AND CLEANING URETHANE PAINT

Because of their resistance to chemicals and solvents, urethane paints and primers require a special paint stripper. If a urethane stripper is not available, a good enamel stripper may be used. Removing the finish with such a substitute will require several applications while working the stripper in with a stiff brush or wooden scraper.

a. Mask around the edge of the skin or skins containing the damaged area. Use a double thickness of heavy paper to prevent accidental splashes of paint stripper from penetrating the masking.

b. Apply urethane stripper as indicated by the manufacturer's direction. Try to stay approximately 1/8 inch away from the masking tape. This will necessitate a little more cleanup upon finishing, but will prevent damage to the finish on the next skin. The stripper will not attack aluminum during the stripping process and can be neutralized afterwards by rinsing the affected area with water.

CAUTION

Urethane strippers usually contain acids that irritate or burn the skin. Wear rubber gloves and eye protection when using the stripper.

c. Rinse the area with water and dry.

d. Wash the stripped area carefully with a solvent such as methyl ethyl ketone or lacquer thinner. This will prevent tiny particles of loose paint from adhering to the stripped area.

e. Using a nylon scratch pad or aluminum wool dipped in water, clean the surface with a cleanser such as Bon Ami, Ajax, Comet cleaner, etc. A good scouring will leave the surface completely clean.

f. Thoroughly rinse with clean water and carefully dry the affected area. If the stripped area includes several joints or skin laps, let the airplane sit until all moisture has dried. This may be accelerated by blowing the skin laps and seams with compressed air. Wet masking should be replaced.

PRETREATMENT (WASH) PRIMER FOR URETHANE PAINT

An acid etching primer that conforms to MIL-C-8514 should be applied to improve adhesion of the finishing coats. EX2016G base and T6070 catalyst (products of Enmar Paint Company, Wichita, Kansas) are used in equal parts as a pretreatment wash primer at the factory.

a. Mix the primer in accordance with the manufacturers instructions.

b. Apply a thin coat of primer. It should be permitted to dry for at least an hour, but not over six hours, before the next coat of urethane paint is applied.

URETHANE PRIMER

a. Mix two parts of the 6165 primer base to one part AA-92-C-4A catalyst (products of U.S. Paint Company, Wichita, Kansas) for intermediate primer.

NOTE

For the best results, these directions must be followed carefully; for some manufacturers require that the primer be allowed to set for 1/2 hour after the catalyst and base have been mixed while others recommend immediate use after mixing.

b. Apply a coat of urethane primer with a spray gun using 35 to 40 psi of air pressure. A dappled appearance indicates that the coat is thin.

c. The primer should be permitted to dry approximately two hours at a temperature of 85° to 90°F at low humidity. When the primer can not be scratched with a fingernail or will not ballup with sandpapering it is ready for the topcoat application.

d. If the initial primer coat is allowed to cure for more than 24 hours before the topcoat is applied, sand the primer coat slightly to roughen the surface and ensure adhesion. Wipe off the sanding dust with a cloth dampened with a solvent (such as lacquer thinner), then apply the topcoat.

URETHANE TOPCOAT APPLICATION

a. Mix the paint and catalyst as directed by the manufacturer.

b. Apply the topcoat with a spray gun at 35 to 45 psi of air pressure. Two coats are normally required to fully conceal the primer and build up the topcoat film for adequate service life and beauty. The urethane finish will normally cure to 85% of its full hardness in 24 hours at temperatures of 80°F or higher.

URETHANE TOUCH-UP REPAIR

a. Mask around the skin containing the damaged area.

b. Remove all loose edges of paint by using a high tack adhesive tape around the edge of the damaged area.

c. Using a coarse sandpaper, fair the edge of the damaged area.

d. When the edge of the paint begins to fair into a smooth joint, use a fine grade of sandpaper to eliminate the scratches left by the coarse paper. Take care to avoid removing any more metal than is absolutely necessary.

e. Wash the sanded area with a solvent, such as lacquer thinner or toluene. (Do not use methyl ethyl ketone as it will soften urethane paint.) Change the wash cloths used for this purpose often so that all the sanding dirt will be picked up.

f. After the area to be touched up has been cleaned with solvent until all traces of discoloration are gone, apply a thin coat of pretreatment primer to the damaged area.

NOTE

If a metal conversion coating such as iridite or alodine is used, the wash primer coating can be dispensed with. If the metal has not been treated with a metal conversion coating and no wash primer is available, carefully clean the surface to be touched up and apply urethane primer to the bare metal. This should produce a satisfactory undercoat for the repair area.

g. After the urethane primer has cured for 24 hours, sand the area under repair with medium fine sandpaper. Sand the edge of the repair area until the indentation where the metal and old paint meet is gone. If necessary, apply additional urethane primer until the juncture of old paint and metal is no longer visible.

h. Spray on two topcoats.

PAINTING MAGNESIUM

PAINT REMOVAL FROM MAGNESIUM SURFACES

a. Mask around the edge of the damaged area with a double thickness of heavy paper to prevent accidental splashes of paint stripper from penetrating the masking.

b. Apply paint stripper (42, Chart 207, 91-00-00) to the skin under repair with a brush or non-atomizing gun.

CAUTION

Stripping should be accomplished in a well ventilated area since prolonged exposure to high concentrates of vapor may irritate the eyes and lungs.

c. Allow the paint stripper to work for 20 to 30 minutes, then work the remaining paint loose with a bristle brush.

CAUTION

Never use a wire brush for it will damage the magnesium surface.

d. Remove the masking paper and wash the affected area thoroughly with water under high pressure. Remove all remnants of paint with lacquer thinner.

e. Sand the repaired area lightly, then apply Dow No. 19 to aid in the prevention of corrosion.

PAINTING MAGNESIUM SURFACES

a. Prepare the surface to be repainted as indicated under PAINT REMOVAL FROM MAGNESIUM SURFACES. Clean the affected area thoroughly with lacquer thinner or an equivalent solvent.

NOTE

Unprimed areas of magnesium castings are to be coated with MIL-C-16173 corrosion preventative compound (43, Chart 207, 91-00-00) unless these areas will come into contact with oil or grease after assembly. Any holes in the castings which will receive bushings or bearings shall be coated with wet unreduced zinc chromate primer or corrosive preventative compound at the time of installation.

b. Prime the affected area and apply either the enamel or urethane topcoat if applicable.

NOTE

Do not apply wash primer to magnesium surfaces. Allow a minimum of four hours drying time between application of the primer and top coat.

SPECIAL PAINT PROCEDURES

PROPELLER BLADES

Paint the backs of the propeller blades with quick drying enamel per MIL-E-5556, color No. 37038 per Federal Standard 595.

LANDING LIGHTS

Paint the landing light wells, excluding the ribs at the inboard and outboard ends, the spar and attaching angles, with quick drying enamel per MIL-E-5556, color No. 37038 per Federal Standard 595.

AIR CONDITIONER EVAPORATOR COMPARTMENT

Apply epoxy primer (24, Chart 207, 91-00-00) to the entire surface area of the parts which make up the compartment.

NOSE RADOME

Sanding surfacer or filler may be used to obtain a smooth surface. Sand with 180 sandpaper just enough to remove the glaze. After sanding, the radome contour shall be free of pits, holes or irregularities which may reduce radar transmissivity and range. If glass laminate fibers are exposed, a hot resin wipe should be applied to seal the laminate and followed with a light sanding with No. 400 sandpaper to remove the glaze. Do not repair with Devcon, body putty or any other plastics which have a different expansion coefficient than the original resin. Apply three thin cross-coats of white elastromeric polyurethane (product of Hughson Chemical Co. Erie, Penn.) consisting of CD 857-40A (two parts by volume) and CD 857-40B (one part by volume) to the forward 15 to 17 inches of the nose cone. The accelerator and base are available in the kit form (P/N CD857-40 1-1/2 pint) through the BEECHCRAFT Dealer Organization. Allow one hour drying time between coats and 48 hours drying time before application of urethane topcoat.

SURFACES SUSCEPTIBLE TO MUD AND SPRAY

Apply one coat of white epoxy paint to the following areas:

1. Main and nose landing gear wheel wells.
2. Interior surface of landing gear doors.
3. Main and nose landing gear assemblies.

RUBBER SEALS

Apply one coat of a thoroughly dissolved solution of one part Oakite No. 6 and two parts water to all rubber surfaces that are to come into contact with metal or other rubber surfaces. Apply a thin coat of Dow Corning No. 7 after the finish top coat is dry.

ENCLOSED AREAS SUBJECT TO HIGH HUMIDITY

Steel, aluminum or magnesium parts and assemblies which are enclosed and subject to high humidity should be protected against corrosion by coating with either epoxy primer, MIL-C-16173 corrosion preventative compound, light grease or heavy oil.

LOWER WING AND FLAP SKINS

If inspection of the lower wing and flap area aft of the exhaust stacks disclose corrosion from fuel lead deposits, remove with a mild soap and water solution. Use a stainless steel wire brush to remove deeper, more resistive corrosion. If corrosion is so deep that 15% or more of the skin thickness is removed, the surface should be replaced. If skin thickness has been reduced by less than 15% (after the corrosion has been removed), the area should be treated with cleaner (41, Chart 207, 91-00-00) or an equivalent corrosion removing compound conforming to MIL-C-38334. The skin should be treated both externally and (where accessible) internally and given a protective coating as described below, then primed and painted. Inspection door nut plates should be removed prior to treating the skins with corrosion removing compound. If corroded, the nut plates should be replaced.

CAUTION

> The corrosion removing compound should be applied in accordance with the manufacturers instructions and cautions.

In addition to the above noted treated skins, new flaps and new skin splices should be treated externally with a protective coating, as described below, primed and painted, and all accessible interior aluminum wing parts on the lower side of the wing, between wing stations 66.00 and 108.281 and aft of the second stringer aft of the front wing spar, should be given a protective coating, as described, and then primed with zinc chromate.

a. Mix Alodine 1200 or 1200S (a product of Amchem Products, Inc., Ambler, Pennsylvania) with water in a ratio of 3 to 4 ounces per gallon of water.

b. Place in a plastic container and allow to dissolve at least one hour.

c. Add 10 milliliters nitric acid per gallon of solution.

d. Prepare the surface by wiping with Stoddard Solvent or methyl ethyl ketone, then scrubbing with a nylon abrasive pad to remove oxide films. Rinse with water and repeat the above procedure until water will not bead on the surface.

e. After cleaning, immediately treat the surface, using a cheesecloth pad, cellulose sponge, or nylon brush to apply the solution with light pressure and continuous, even motion. On curved or inclined surfaces, begin application at the lower edge of the work to minimize streaking. Keep the surface wet with the solution for 1 to 3 minutes so that a continuous film is obtained, with neither a grayish appearance nor a dark, powdery, non-adherent coating. Generally, a light coating, rather than a heavier coating is preferable for a paint base, especially for epoxy primers. Streaks from brushing, or rundown of excess solution are allowable, as are slight chromic acid stains.

f. Remove excess solution with cold running water or a cheesecloth pad wetted with clean water. Never use a high pressure hose rinse, since the freshly formed chemical film will be removed or damaged. All treated parts should be kept clean before priming and painting, which should follow the chemical film application as soon as practical.

"END"

CHAPTER 21

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CHAPTER 21

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CHAPTER 21 - AIR CONDITIONING

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GENERAL - DESCRIPTION AND OPERATION

PRESSURIZATION SYSTEM

Pressurized air for the cabin is taken downstream from the turbocharger compressor of each engine and reduced to a usable flow by a sonic nozzle (or venturi). When sonic velocity is reached by the air flowing through the throat of the nozzle, each engine is producing the maximum flow rate of 4 to 5 pounds per minute. Total air flow from both engines will deliver approximately 8 to 10 pounds per minute and maintain a cabin pressure differential of 4.6 psi.

The air then passes through a firewall shutoff valve, through an intercooler and into the cabin beneath the pilot and copilot floorboards. The intercooler reduces the heat acquired by the air during pressurization with a flow of ram air from a scoop at the leading edge of each wing root. Within the cabin pressure vessel a check valve is installed at each pressurization outlet. In the event of an engine failure at altitude the check valve will close on the dead engine side, preventing a loss of cabin pressurization.

Located on the forward side of the aft pressure bulkhead (P-3 through P-246) and on the aft side of the aft pressure bulkhead (P-247 and after) are two valves; the differential control valve and the safety/dump valve. A pressurization controller on the right subpanel pneumatically regulates the differential control valve to maintain the selected cabin altitude.

AIR CONDITIONING SYSTEM

The optional air conditioning system is a recirculating air cooling system containing a 16,000 BTU refrigerative type cooler. The unit is controlled by an automatic temperature control and three sensing elements.

A six position mode switch controls the heater and air conditioner system; however, each system operates independently of the other. When placed in AUTO position, the temperature is automatically controlled through the temperature controller located on the forward pressure bulkhead above the pilot pedals. It also regulates the cabin temperature variations monitored at the sensing units. The sensing units are located in the ram air inlet, heater outlet duct and forward of the two pressure control valves on the rear pressure bulkhead. When placed in the MANUAL COOL HI position, the switch bypasses the automatic controls and allows maximum air conditioning output. The maximum output is limited by an evaporator thermal switch and an overpressure switch. The MANUAL COOL LO position allows a hot-gas bypass valve (if installed) to be cycled on and off by a timer. The bypass valve regulates the flow of the refrigerant to the condenser allowing partial cooling of the cabin.

On serials P-123, P-127 and after, and prior airplanes which have complied with Service Instructions 0320-426 a MANUAL COOL position replaces the MANUAL COOL HI and LO positions on the mode selector switch. Two BLOWER positions are placed on the mode switch to allow the blower to be selected without cycling through the opposite mode.

The air scoop and ramp assembly located in the upper RH nacelle controls the air circulation through the condenser compartment and is completely automatic. The air scoop and ramp assembly has three positions; "closed" (when the air conditioning is not in use), "flight" (air scoop extended about 2 inches above the nacelle), and "ground" (air scoop fully extended). When the air conditioning is turned on, a switch incorporated on the landing gear selects air scoop position; gear down, the air scoop will open to the "ground" position; gear off the ground, the air scoop will open or lower to the "flight" position. The condenser fan, which is wired in circuit with the landing gear uplock switch, operates only when the air conditioning mode is selected and the airplane is on the ground.

The air conditioning system is similar to many home and automotive units and consists of six major components. The belt-driven compressor, which is coupled by a magnetic clutch, compresses the refrigerant to a high pressure, high temperature gas. This gas passes through the condenser where cooling air removes heat from the gas, condensing it to a liquid state. The liquid is then passed through the receiver-dryer where any moisture or foreign material is removed from the system. The refrigerant flows to the expansion valve where it is metered into the evaporator at a rate which allows all the liquid to return to a gas. The heat required for evaporation is absorbed from the cabin air passing over the evaporator coils. After passing through the evaporator, the refrigerant returns to the compressor at a reduced pressure. For partial cooling, a hot gas bypass valve allows a portion of the gas to bleed off from the condenser, cycling back through the compressor.

NOTE

Beginning with airplane serials P-123, P-127 and after, and prior airplanes having installed Kit Number 60-5006, the hot gas bypass valve, line and suction accumulator were removed from the system.

An overpressure switch and a pressure relief valve are incorporated into the system to regulate system (compressor discharge) pressure. The overpressure switch is located in the condenser compartment of the right nacelle and is set to actuate at 375 ± 10 psi. When this switch is actuated, power is removed from the compressor magnetic clutch and the 3 amp fuse is shorted through a resistor to the airplane structure. The fuse is thus opened, preventing further operation of the compressor magnetic clutch and the compressor until the system has been serviced. A pressure relief valve, located on the compressor discharge line immediately before it enters the condenser, is set to bleed off pressure at 450 psi.

On airplane serials, P-275 and after, and on those prior airplanes which are in compliance with the Service Instructions 0599-427, a low pressure switch is installed on the evaporator. This switch is designed to actuate when the refrigerant pressure drops to 7 ± 1 psi. The actuation of the low pressure switch shorts the 3 ampere fuse to airplane structure through the resistor located near the evaporator. The fuse, located in the right nacelle, is thus opened, preventing further operation of the compressor magnetic clutch and the compressor until the air conditioner system has been serviced.

NOTE

The low pressure switch which was originally installed on airplane serials P-275 through P-292 and P-294, prior to compliance with Service Instructions 0599-427, actuated at a pressure of 18 ± 2 psi.

HEATER SYSTEM

The heater system consists of a 45,000 BTU combustion air heater, (located under the nose baggage compartment floor), a six position mode switch, vent air blower, combustion air blower, heater fuel pump, five outlets, an automatic temperature control and three sensing elements.

In flight, when pressurized, the vent blower obtains air through the cabin air check valve, forces it through the heater and to the cabin outlets. In the unpressurized mode, in flight and for ground operations, the vent blower obtains air from the cabin and the ram air plenum chamber and forces it through the heater and to the cabin outlets.

On serials P-3 through P-126, except P-123, a vent air distribution bypass valve, located on the forward pressure bulkhead, allows air to be directed into the pilot's compartment area and is regulated by a control knob on the pilot's left subpanel.

"END"

TROUBLESHOOTING PRESSURIZATION SYSTEM (P-3 THRU P-307)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Unable to pressurize	a. Cabin altitude control inoperative.	a. Check by isolating control from system (see PRESSURIZATION TEST PROCEDURE in this chapter).
	b. Differential control valve inoperative.	b. Check by isolating control valve from system (see PRESSURIZATION TEST PROCEDURE in this chapter).
	c. Dump solenoid stuck in open position.	c. Cycle pressure circuit breaker, listen for operation of dump solenoid; replace if inoperative.
	d. Vacuum solenoid stuck in open position.	d. Cycle pressure circuit breaker, listen for operation of vacuum solenoid; replace if inoperative.
	e. Cabin altitude control sense line restricted.	e. Disconnect sense line at both ends and purge.
	f. Differential control valve seats dirty.	f. Clean the valve seats with a lint-free cloth moistened with alcohol. For additional information relating to overhaul and cleaning procedures refer to Component Maintenance Manual P/N 60-590001-27.
	g. Firewall shutoff valves pulled closed.	g. Open valves.
	h. Hole in flex ducts from engine.	h. Inspect and repair or replace as required.
	i. Excessive pressure leaks in cabin, (door seal etc.)	i. Check cabin for leaks; repair as required.
2. No pressure indication on ground.	a. Press-to-test switch inoperative.	a. Replace switch.
	b. Rate-of-climb indicator inoperative.	b. Replace indicator.
	c. Dump switch in dump position.	c. Place switch in pressure position.
	d. Manifold pressure too low during check.	d. Increase manifold pressure to a minimum of 20 in. Hg.

TROUBLESHOOTING
PRESSURIZATION SYSTEM (Cont'd)
(P-3 THRU P-307)

TROUBLE	PROBABLE CAUSE	REMARKS
3. Maximum cabin differential pressure exceeds 4.6 psi.	a. Differential control valve inoperative.	a. Clean valve as described in the Component Maintenance Manual, P/N 60-590001-27, or replace valve.
	b. Cabin altitude and differential pressure indicator inoperative.	b. Replace indicator.
	c. Ambient air sense line between safety and differential control valve leaking.	c. Inspect lines and fittings; tighten or replace as required.
4. Maximum cabin differential pressure exceeds 4.9 psi.	a. Safety valve and differential control valve inoperative.	a. Clean valve as described in the Component Maintenance Manual, P/N 60-590001-27, or replace valve.
	b. Ambient air sense line between safety and differential control valve ruptured, loose fittings.	b. Inspect lines and fittings; tighten or replace as required.
5. Cabin pressure slow to respond to change in selected cabin altitude.	a. Cabin altitude control sense line kinked or restricted.	a. Inspect and repair or replace as required.
	b. Cabin altitude control filter clogged.	b. Replace filter.
6. Cabin altitude higher than selected altitude.	a. Cabin altitude controller out of adjustment.	a. Adjust controller.
	b. Cabin altitude indicator inoperative.	b. Replace indicator.
	c. Cabin altitude control sense line kinked or restricted.	c. Inspect and repair or replace as required.
	d. Cabin altitude control inoperative.	d. Replace control.
	e. Cabin altitude control filter restricted.	e. Clean filter.
7. Cabin altitude lower than selected altitude (not exceeding maximum cabin differential pressure).	a. Cabin altitude controller out of adjustment.	a. Adjust controller.
	b. Cabin altitude control sense line leaks.	b. Inspect and repair or replace as required.

TROUBLESHOOTING
PRESSURIZATION SYSTEM (Cont'd)
(P-3 THRU P-307)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
7. Cabin altitude lower than selected altitude (Not exceeding maximum cabin differential pressure).	c. Cabin altitude indicator inoperative.	c. Replace indicator.
8. Cabin pressure fluctuation.	a. Valve seats dirty.	a. Clean the valve seats with a lint-free cloth moistened with alcohol. For additional information relating to overhaul and cleaning procedures refer to Components Maintenance Manual P/N 60-590001-27.
9. Cabin pressure fluctuates when deice system is cycled (with dump switch in either dump or pressure mode).	a. The check valve in the differential control valve vacuum line is installed backward.	a. Install check valve properly.
	b. Check valve is dirty.	b. Clean check valve.
10. Cabin pressure fluctuates with dump switch in dump mode.	a. Vacuum solenoid inoperative	a. Replace vacuum solenoid.
	b. Dump solenoid inoperative.	b. Replace safety valve.
11. Pressure circuit breaker tripped.	a. Dump solenoid shorted.	a. Locate cause, repair and reset circuit breaker.
	b. Vacuum solenoid shorted.	b. Locate cause, repair and reset circuit breaker.
	c. Press-to-test switch shorted.	c. Locate cause, repair and reset circuit breaker.
	d. Landing gear safety switch shorted.	d. Locate cause, repair and reset circuit breaker.
	e. Wire harness shorted.	e. Locate cause and repair.
	f. Wire harness improperly installed.	f. Inspect and rewire as required.
	g. Pressure circuit breaker inoperative.	g. Replace circuit breaker.
12. Airplane pressurizes on ground.	a. Landing gear safety switch inoperative.	a. Replace switch.
	b. Open lead in wire bundle.	b. Locate and repair.

TROUBLESHOOTING PRESSURIZATION SYSTEM (Cont'd) (P-3 THRU P-307)

TROUBLE	PROBABLE CAUSE	REMARKS
12. Airplane pressurizes on ground.	c. Circuit breaker tripped.	c. See "11" above.
	d. Press-to-test switch inoperative.	d. Replace switch.

TROUBLESHOOTING PRESSURIZATION SYSTEM (P-308 AND AFTER)

TROUBLE	PROBABLE CAUSE	REMARKS
1. Unable to pressurize.	a. Cabin altitude controller inoperative.	a. Check by performing PRESSURIZATION TEST.
	b. Outflow valve inoperative.	b. Check by performing PRESSURIZATION TEST.
	c. Dump valve solenoid stuck in open position.	c. Cycle pressurization system circuit breaker, check for operation of solenoid; replace if inoperative.
	d. Shutoff solenoid in cabin controller supply line stuck in closed position.	d. Cycle pressurization system circuit breaker, check for operation of solenoid; replace if inoperative.
	e. Outflow valve control line restricted.	e. Check for restrictions; repair or replace.
	f. Outflow valve and safety valve seats dirty.	f. Clean the valve seats with a lint-free cloth moistened with isopropyl alcohol.
	g. Firewall shutoff valves pulled closed.	g. Open valves.
	h. Hole in flex ducts from engine.	h. Inspect and repair or replace as required.
	i. Excessive pressure leaks in cabin (door, seal, etc.)	i. Check cabin for leaks; repair as required.

TROUBLESHOOTING
PRESSURIZATION SYSTEM (Cont'd)
(P-308 and after)

	TROUBLE	*PROBABLE CAUSE*	*REMARKS*
2.	No pressure indication on ground.	a. Pressurization system switch inoperative.	a. Replace switch.
		b. Rate-of-climb indicator inoperative.	b. Replace indicator.
		c. Manifold pressure too low during check.	c. Increase manifold pressure to a minimum of 20 in. Hg.
3.	Maximum cabin differential pressure exceeds 4.6 psi.	a. Cabin altitude and differential pressure indicator inoperative.	a. Replace indicator.
		b. Safety valve and outflow valve out of adjustment.	b. Replace valves.
		c. True static air vent tubes loose or damaged.	c. Inspect lines and fittings; tighten or replace as required.
4.	Cabin pressure slow to respond to change in selected cabin altitude.	a. Cabin pressurization control supply line or the outflow valve control line kinked or restricted.	a. Inspect lines and fittings; repair or replace as required.
		b. Cabin pressurization controller filter restricted.	b. Clean filter.
5.	Cabin altitude higher than selected altitude.	a. Cabin altitude controller out of adjustment.	a. Replace controller.
		b. Cabin altitude indicator inoperative.	b. Replace indicator.
		c. Cabin pressurization controller inoperative.	c. Replace controller.
		d. Cabin pressurization controller filter restricted.	d. Clean filter.
		e. Outflow valve control line kinked or restricted.	e. Inspect, repair as necessary.
6.	Cabin altitude lower than selected altitude. (Not exceeding maximum differential pressure).	a. Cabin pressurization controller out of adjustment.	a. Replace controller.

TROUBLESHOOTING
PRESSURIZATION SYSTEM (Cont'd)
(P-308 and after)

TROUBLE	PROBABLE CAUSE	REMARKS
6. Cabin altitude lower than selected altitude (not exceeding maximum differential pressure).	b. Cabin altitude controller supply line or outflow valve control line leaks.	b. Inspect, repair or replace as required.
	c. Cabin altitude indicator inoperative.	c. Replace indicator.
7. Cabin pressure fluctuation.	a. Valve seats dirty.	a. Clean the valve seats with a lint-free cloth moistened with isopropyl alcohol.
8. Cabin pressurization system circuit breaker tripped.	a. Dump valve solenoid shorted.	a. Locate cause, repair or replace defective component, reset circuit breaker.
	b. Shutoff solenoid in cabin pressurization controller shorted.	b. Locate cause, repair or replace defective component, reset circuit breaker.
	c. Pressurization system circuit shorted.	c. Locate cause, repair or replace defective component, reset circuit breaker.
9. Airplane pressurizes on ground.	a. Landing gear safety switch inoperative or improperly rigged.	a. Replace or adjust the RH landing gear safety switch.
	b. Open circuit in cabin pressurization circuit.	b. Locate cause, repair or replace defective component.

TROUBLESHOOTING
HEATER SYSTEM

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Heater fails to light.	a. Master switch or circuit breaker off.	a. Turn on master switch or close circuit breaker.
	b. Low voltage supply.	b. Apply external power supply. Attempt to start heater.
	c. Fuel cut off from tank.	c. Turn on manual shutoff valve (if used) or master solenoid.
	d. Suction leak ahead of pump.	d. Secure all fittings.
	e. Insufficient fuel pressure.	e. Low or no current to fuel pump. Check for operation of pump and remove for repairs if not operating.
	f. Regulator not operating properly.	f. Check for low pressure or replace regulator.
	g. Fuel pump operating but not building up sufficient pressure.	g. Remove and repair or replace fuel pump.
	h. Restriction in fuel nozzle orifice.	h. Remove the nozzle and clean or replace it.
	i. Fuel heater solenoid not operating.	i. Remove and check solenoid. Replace if faulty.
	j. Fuel lines clogged or broken.	j. Inspect all lines and connections. It may be necessary to disconnect lines at various points to determine where the restriction is located.
	k. Fuel filter clogged.	k. Clean fuel filter element.
	l. Ignition vibrator inoperative.	l. Replace vibrator; check for defective radio noise filter.
	m. Manual reset limit (overheat) switch open.	m. Press reset button firmly and recheck to determine reason for switch opening.
	n. Combustion air pressure switch open. (Defective switch or low combustion air blower output.)	n. Check for low blower output due to low voltage and correct it. If switch is defective, replace it.
	o. Cycling switch open.	o. Replace if defective.
	p. Duct switch open.	p. Operate control to see if switch will come on. Replace switch if defective.

TROUBLESHOOTING
HEATER SYSTEM (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
2. Ventilating air blower fails to run.	a. MASTER switch OFF. Broken or loose wiring to motor.	a. Energize the MASTER switch. Check and repair wiring.
	b. Circuit breaker open.	b. Close circuit breaker.
	c. Worn motor brushes.	c. Replace motor brushes.
	d. Blower wheel jammed.	d. Remove and check the ventilating air blower wheel and realign if necessary.
	e. Motor burned out.	e. Remove blower assembly and remove motor.
	f. Defective radio-noise filter.	f. Replace filter.
3. Combustion air blower fails to run.	a. Faulty wiring to motor.	a. Inspect and replace faulty wiring.
	b. Poor ground connection.	b. Tighten ground screw.
	c. Worn motor brushes.	c. Replace motor brushes.
	d. Blower wheel jammed. (Usually indicated by hot motor housing.)	d. Overhaul the combustion air blower.
	e. Defective radio-noise filter.	e. Replace filter.
	f. Faulty or burned-out motor.	f. Remove combustion air motor for overhaul or replacement of motor.
4. Heater fires but burns unsteadily.	a. Insufficient fuel supply.	a. Inspect fuel supply to heater including shut-off valve, solenoid valve, fuel filter, fuel pump and fuel lines. Make all necessary repairs.
	b. Spark plug partially fouled.	b. Replace spark plug.
	c. Loose primary connection at ignition assembly.	c. Tighten the connection.
	d. Faulty vibrator.	d. Replace the vibrator.
	e. Combustion air blower speed fluctuates. (Can be caused by low voltage, loose blower wheel, worn brushes or motor.)	e. Remove and overhaul the combustion air blower assembly as required or correct low voltage condition.

TROUBLESHOOTING
HEATER SYSTEM (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
4. Heater fires but burns unsteadily (Cont'd).	f. High-voltage leak in lead between ignition assembly and spark plug.	f. Replace ignition assembly.
	g. Inoperative ignition assembly.	g. If vibrator is in good condition, replace ignition assembly only.
	h. Restriction in fuel nozzle orifice.	h. Remove nozzle for cleaning or replacement.
	i. Nozzle loose in retainer or improper spray angle.	i. Tighten or replace the nozzle as required.
5. Heater starts then goes out.	a. Lack of fuel at heater.	a. Check fuel supply through all components from the tank to the heater. Make necessary corrections.
	b. Inoperative or chattering combustion air pressure switch.	b. Check, adjust, or replace switch.
	c. Inoperative overheat switch.	c. Check or replace switch.
	d. Inoperative cycling switch.	d. Adjust or replace the switch.
	e. Low voltage.	e. Attach external power.
6. Heater fails to shut off.	a. Fuel solenoid valve in heater stuck open.	a. Remove and replace solenoid assembly.
	b. Inoperative duct and cycling switch.	b. Check and repair.
	c. Defective MASTER switch.	c. Replace the MASTER switch.

AIR CONDITIONING SYSTEM

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Insufficient cooling.	a. Blower not functioning.	a. Repair.
	b. Obstructed or disconnected air duct.	b. Remove obstruction or repair.
	c. Compressor clutch or belt slipping.	c. Repair or adjust.
	d. Evaporator filter clogged.	d. Replace.
	e. Refrigerant level low.	e. Leak-test and recharge.
	f. Hot gas bypass valve defective.	f. Replace.

TROUBLESHOOTING
AIR CONDITIONING SYSTEM (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
2. No cooling.	a. Loose connection.	a. Check connections, continuity.
	b. Blower not functioning.	b. Repair.
	c. Leak in system.	c. Leak-test and recharge.
	d. Compressor reed valves inoperative.	d. Repair or replace.
	e. Expansion valve stuck open.	e. Replace.
	f. Blown fuse.	f. Service air conditioning system. Check for over-pressure, purge and recharge if necessary. Leak-test and recharge if pressure is low.
3. Air conditioner will not operate in AUTO mode but will function in the MAN COOL mode.	a. Misadjustment of heater control box.	a. Replace.
	b. Malfunction of control box.	b. Replace.
	c. Malfunction of temperature sensing elements.	c. Replace.
4. Air conditioner runs constantly in either AUTO or MAN COOL.	a. Malfunction of temperature sensing elements.	a. Replace.
5. Excessive vibration of unit.	a. Overcharged.	a. Correct refrigerant charge.
	b. Air in system.	b. Purge and recharge system.
	c. Mount or compressor bolts loose.	c. Tighten.
	d. Drive pulley loose.	d. Tighten.
6. Noisy unit.	a. Compressor oil level low.	a. Add oil.
	b. Defective belt.	b. Replace.
	c. Low refrigerant level.	c. Add refrigerant.
	d. Excessive moisture in system.	d. Replace receiver-dryer and recharge.

TROUBLESHOOTING
AIR CONDITIONING SYSTEM (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
6. Noisy unit. (Cont'd)	e. Fan hitting shroud.	e. Align and tighten shroud.
	f. Defective compressor.	f. Replace.
7. Hissing in evaporator case.	a. Low charge.	a. Add refrigerant.
8. Chatter or knock in evaporator case.	a. Defective expansion valve.	a. Replace.
9. Belt slipping.	a. Loose	a. Adjust.
	b. Overcharged.	b. Correct refrigerant level.
	c. Air in system.	c. Evacuate and recharge.
10. Excessive belt wear.	a. Pulleys not in line.	a. Align pulleys.
	b. Belt too tight.	b. Adjust or replace.
	c. Pulley groove wrong size.	c. Replace.
	d. Belt width wrong.	d. Replace.
11. Broken belt.	a. Check all causes above.	a. Replace.

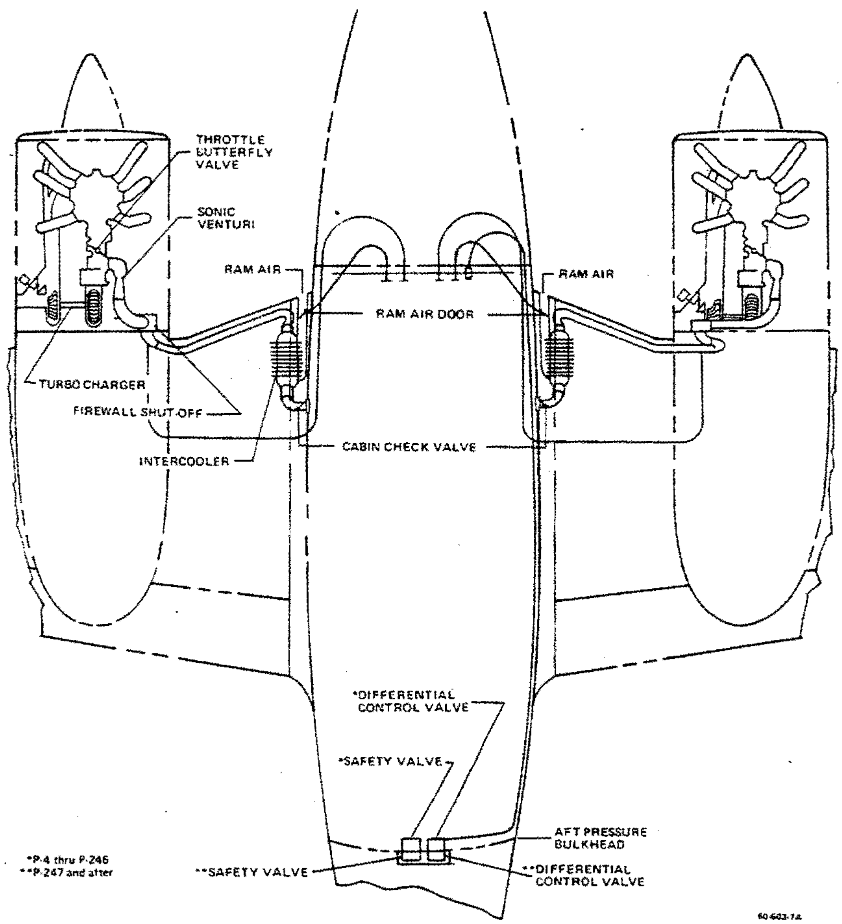
"END"

COMPRESSION - DESCRIPTION AND OPERATION

(Figure 1)

Pressurized air for the cabin is supplied by the turbocharger compressor mounted on the same shaft as the turbocharger. In operation, engine exhaust gas passing over the turbine wheel causes the turbocharger compressor to rotate. Ambient ram air, supplied through the RH cowl door, is filtered and routed to the compressor where it is compressed and delivered to the cabin through a sonic nozzle. When sonic velocity is reached by the air flowing through the throat of the nozzle, each engine is producing the maximum flow rate of 4 to 5 pounds per minute. Total air flow from both engines will deliver approximately 8 to 10 pounds per minute and maintain a cabin pressure differential of 4.6 psi.

A pressurization air intercooler, located in each wing root, is used for temperature control of pressurization air before it enters the cabin. Air flow through the intercoolers is controlled by a butterfly valve located in a ram air scoop under each wing root leading edge. The butterfly valves are manually actuated by the intercooler temperature controls located on the RH subpanel. For maximum temperature control and to reduce the load on the heating and air conditioning system, the intercooler temperature controls should be positioned in the closed position when the air condition system is in the HEAT mode and in the ope position when in the COOL mode.



Pressurization System
Figure 1

"END"

COMPRESSION - MAINTENANCE PRACTICES

INTERCOOLER REMOVAL

a. Remove the fiberglass air intake duct located on the lower forward side of the wing stub.

b. Remove the skin panel under the air intake duct.

c. Loosen the clamps attaching the flex duct on each end of the intercooler.

d. Loosen the set screw and remove the push-pull control cable.

e. Remove the three lower screws and the upper bolt attaching the intercooler to the outboard wing stub rib.

f. Remove the intercooler through the bottom access opening.

INTERCOOLER INSTALLATION

a. Position the intercooler in place through the bottom access opening.

b. Install the three lower screws and the upper bolt attaching the intercooler to the outboard wing stub rib.

c. Attach the push-pull control cable and tighten the set screw.

d. Attach the flex duct on each end of the intercooler and tighten the clamps.

e. Install the skin panel under the air intake duct.

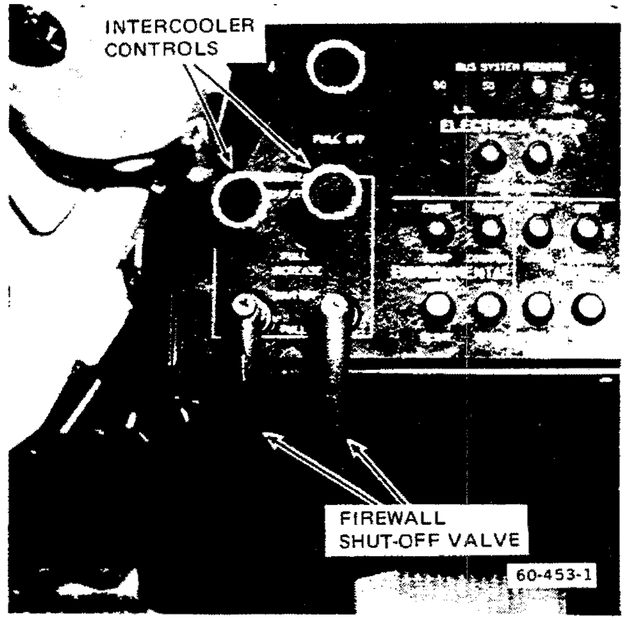
f. Install the fiberglass air intake duct and seal with EC 1792 sealant (Chart 205, Chapter 91-00-00).

INTERCOOLER CONTROL RIGGING
(Figure 201)

The controls used on the intercooler installation are the push-pull type. In the event the control needs minor adjustment, a set pin with a hole provided for the control wire, may be tightened if loose.

NOTE

Make an operational check of the push-pull control for correct adjustment and full travel.



Intercooler and Firewall Shut-off Valve Controls
Figure 201

FIREWALL SHUT-OFF VALVE
(Figure 201)

During normal flight operations, the FIREWALL SHUT-OFF VALVE controls are pushed in against the lower RH subpanel. This will allow maximum airflow to enter the cabin. In the event of a fire inside the engine cowl, immediately pull the red handled control out to the stop. This will shut off the air flow from the inoperable engine. A check valve located just inside the pressurization airflow inlet will close and prevent complete loss of cabin pressurization.

This control is preset at the factory and should not need any further adjustment.

"END"

PRESSURIZATION CONTROL - DESCRIPTION AND OPERATION (P-3 THRU P-307)

Cabin altitude is selected and controlled by the cabin altitude controller, located on the RH subpanel. A standard, manual controller is utilized by the various series of the Duke which do not use the optional motorized controller. The optional motorized controller is utilized by the various series of the Duke as either a factory installed unit or upon compliance with Service Instructions 0479-453. The motorized controller is similar to the manual controller except in the method of changing cabin altitude. Both controllers employ an aneroid bellows-controlled valve to allow a calibrated amount of air flow to the control diaphragm of the differential control valve.

PRESSURIZATION SYSTEM OPERATIONAL CHARACTERISTICS

a. Power Changes - Normal application of power from a standing start or taxiing will produce a momentary fluctuation of the pressure level. A momentary fluctuation of 1,000 fpm (read on the cabin rate-of-climb indicator) is normal and should provide little or no passenger discomfort. This variation is minimized by slower application of power. More rapid application of power will cause a higher momentary fluctuation and is also considered normal.

b. Lift Off - As the airplane leaves the ground, a momentary cabin pressure fluctuation of as high as 1,500 fpm (1,000 fpm for airplane with a dashpot installed on safety valve) is considered normal and again will rarely produce passenger discomfort.

c. Altitude Control - As the airplane reaches and climbs through the pre-set altitude, the cabin rate-of-climb will slowly come to a zero point. As the cabin altitude and the selected altitude begin to come together (at the pre-set altitude), a pressure fluctuation may be noticed (1,000 fpm is normal). Stabilization of the two altitudes within 500 feet of each other can be expected until maximum differential pressure is reached.

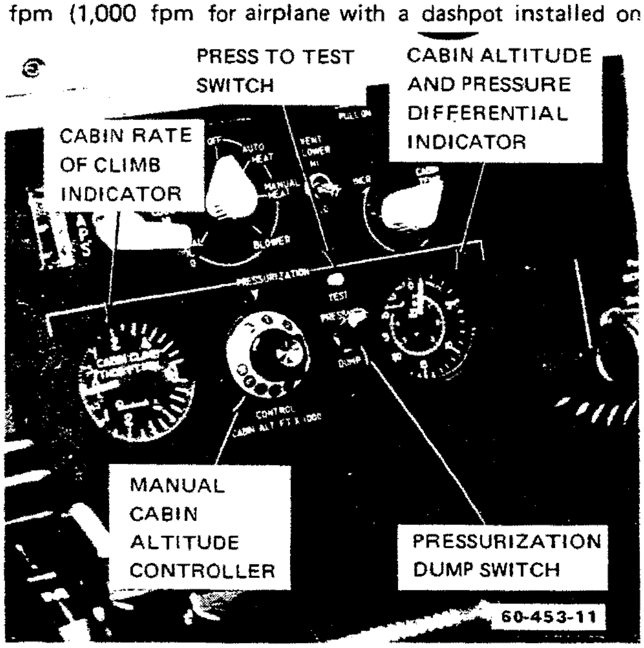
d. Maximum Differential Pressure - As the cabin leaves the isobaric altitude control and goes on maximum differential pressure control, it will make an adjustment and a fluctuation of 500 fpm may be noted before it stabilizes to the normal rate-of-climb of the airplane. Again little or no passenger discomfort should be experienced.

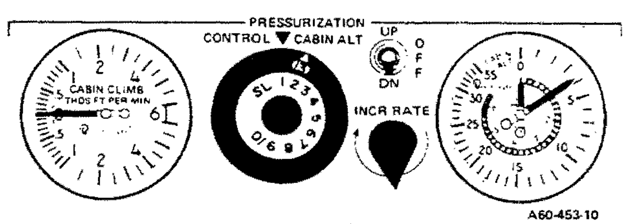
e. Power Reductions - A sudden power reduction or loss of power on one engine below 20 in. Hg MP will cause a change in engine pressurization air flow. Therefore, cabin pressure will be affected and cabin pressure fluctuation will be experienced. A fluctuation of 2,000 fpm is normal under these conditions.

f. Pressurization at Minimum Power - A maximum differential pressure (4.6 psi) may be expected at any throttle setting of 20 in. Hg MP or above on both engines or during single engine operation with the operating engine at 65% power or above, at an altitude of 20,000 feet or above.

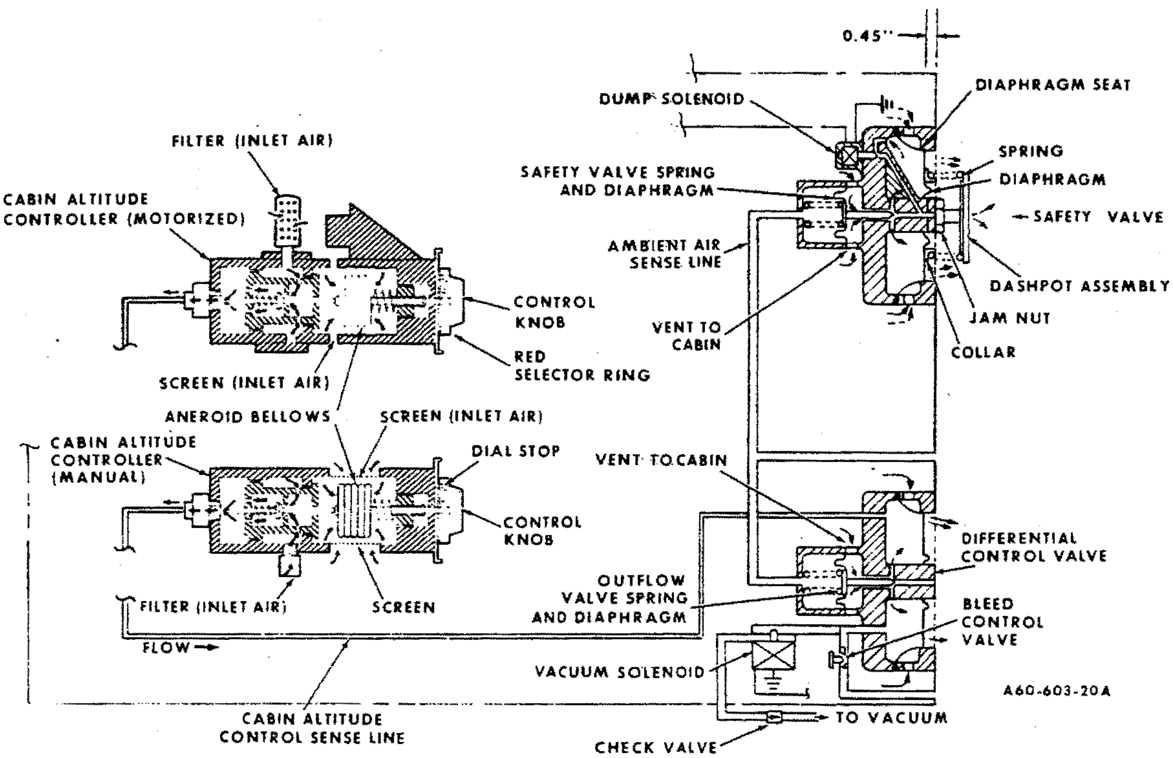
Once the isobaric altitude is set (this is the altitude at which the cabin starts to pressurize), it should be left there until the cabin reaches maximum differential pressure. Once this altitude is reached, the controller can be reset to any lower altitude with no effect on cabin altitude. To change it under any other condition should be done with caution as rapid fluctuations can take place. A recommended practice is, prior to take-off, set the controller to 1,000 feet above the altitude of the departure field or the arrival field whichever is the highest. By doing this the controller does not have to be reset in flight and a smooth comfortable pressurized flight can be expected.

The following graph is provided to determine the relationship between cruise altitude, cabin altitude and differential pressure. The zero differential pressure line



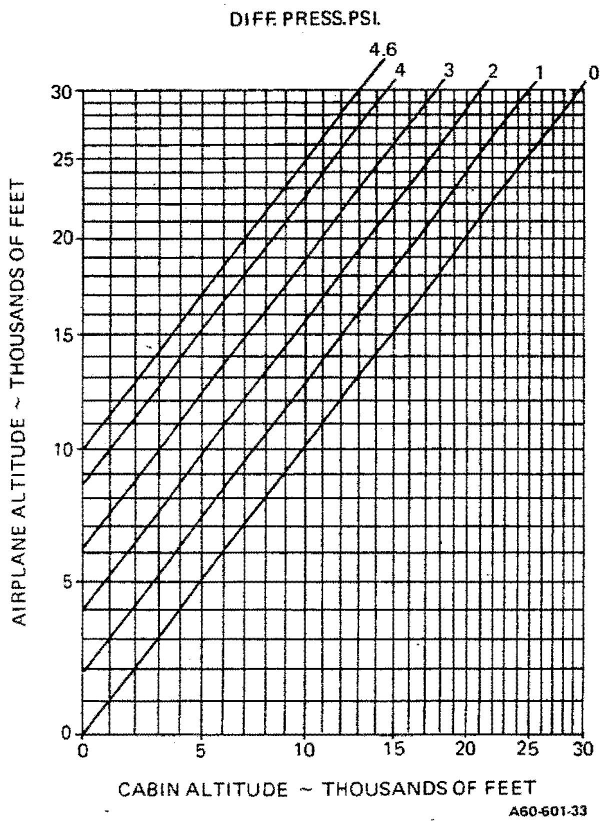


Pressurization Controls
Figure 1



Pressurization Control System Schematic
(P-3 thru P-307)
Figure 2

indicates that the cruise altitude and the cabin altitude are identical (unpressurized). The 4.6 psi line indicates the maximum differential pressure obtainable in the cabin. To determine the lowest cabin altitude which can be maintained for a given cruise altitude: enter the graph at the desired cruise altitude and read right to the 4.6 psi differential pressure line. Then read down the graph to the altitude which can be maintained in the cabin.



Effectual Pressure Graph
Figure 3

CABIN ALTITUDE CONTROLLER (MANUAL) (PRIOR TO P-308)

Cabin altitude is maintained by the cabin altitude controller with the control anywhere from zero pressure to the maximum differential of 4.6 psi.

The controller is rotated until the desired cabin altitude for flight is at the 12 o'clock position under the index mark. Any selected cabin altitude will be maintained during the flight provided the cabin pressure is at or below the maximum differential pressure. If the cabin reaches the maximum differential of 4.6 psi and the airplane is still climbing the cabin altitude will climb with the airplane.

If a cabin altitude change is required in flight it can be accomplished with a minimum of abrupt cabin pressure change by turning the selector dial very slowly and monitoring the rate of change on the cabin pressure indicator. A time lapse of approximately two minutes for each thousand-foot increment change on the dial will effect a comfortable change of pressure. Rapid cabin pressure changes will be experienced if the altitude selector is moved quickly before reaching the maximum differential pressure of 4.6 psi.

CABIN ALTITUDE CONTROLLER (MOTORIZED) (PRIOR TO P-308)

The motorized controller is designed to maintain a constant cabin altitude rate of change during airplane climbs and descents and to make available a means of cabin altitude programming. It can best be described as an adjustable isobaric controller incorporating a variable speed drive motor with automatic shut off. The additional controls for the unit are the red altitude selector ring, the motor rate rheostat and the directional toggle switch. The inner cabin altitude selector is normally operated with the directional toggle switch. The control can be moved to override the motor drive but under normal operation all movement should be made with the toggle switch. The inner scale shows the cabin altitude when read at the index mark (12 o'clock position). The outer scale under the window shows the selected airplane altitude. The inner scale adjacent to the window shows what the cabin altitude will be when maximum differential pressure (4.6 psi) is reached.

To ready the unit for operation, place the rate rheostat knob in the mid-range and insure that the directional toggle switch is in the off position.

CAUTION

> In event the directional toggle switch is positioned improperly, the controller will drive to the end of the scale and damage to the slip clutch may result.

Manually set the cabin altitude controller (inner scale) to approximately 1,000 feet above the take-off field elevation. (The red altitude selector ring will turn with the inner scale when this adjustment is made). Now set the window on the red altitude selector ring to 1,000 feet above the planned airplane's cruise altitude. This will avoid reaching maximum differential pressure in the cabin prior to achieving cruise altitude.

After take-off and during the climb when the cabin rate of climb has returned to zero, move the directional toggle switch to the up position. This gradually climbs the cabin to the altitude which is opposite the altitude in the window on the red selector ring. The controller should be driven at a rate to arrive at the cabin altitude shortly before the airplane arrives at the cruise altitude. This can be accomplished by increasing or decreasing the rate rheostat knob. A few seconds lag time must be allowed for the pressurization controls to respond and stabilize before reading the cabin altitude rate of climb indicator. The controller will automatically turn off when the window in the red selector ring reaches the 12 o'clock position. However, the directional switch should be placed in the OFF position.

CAUTION

In the event the directional toggle switch is positioned improperly, the controller will drive to the end of the scale and damage to the slip clutch may result.

For normal descent turn the red selector ring until the window is opposite the altitude which is 1,000 feet above the landing altitude. After departing the original altitude, place the directional toggle switch in the down position. In the event that a rapid descent rate is required, set the rate rheostat for an increased rate of descent so as to maintain a higher airplane altitude than cabin altitude throughout the descent.

If the cruise altitude selected is less than 11,000 feet or corresponding cabin altitude (below the window) is less than the take-off field elevation, then the controller need not be moved. However, if the landing altitude is less than the take-off field elevation then the controller can be driven down to the selected cruise altitude.

DIFFERENTIAL CONTROL VALVE AND SAFETY VALVE (PRIOR TO P-308)

A differential control valve and a safety valve are located on the forward side of the aft pressure bulkhead.

NOTE

On airplane serials P-247 and after the outflow valve and safety valve are mounted within a box structure which is a portion of the aft pressure bulkhead.

The differential control valve regulates cabin pressure up to maximum differential pressures of 4.6 to 4.7 psi. A diaphragm in the valve, controlled by the cabin altitude control, closes but allows a preset amount of cabin air to bleed off into the tail section through an adjustable bleed valve. This maintains the selected cabin altitudes up to maximum differential pressure. The differential control feature of the valve maintains cabin pressure at maximum differential pressure (4.6 to 4.7 psi) only. The differential control utilizes a diaphragm that applies pressure against a spring-loaded needle valve. When cabin pressure reaches maximum differential pressure, the diaphragm pushes against the needle valve, allowing cabin air to bleed off into the tail section. As cabin air bleeds off, the diaphragm allows the needle valve to return to its normal position; thus the diaphragm modulates the needle valve between the open and closed position to maintain the proper pressure.

On serials P-3 through P-126, except P-123, the safety valve incorporates a solenoid valve which is wired to the landing gear safety switch. When the airplane touches down, the safety valve will energize and dump the cabin pressure overboard. A manual dump switch, located on the RH subpanel will also energize the solenoid and dump pressure overboard while in flight. On serials P-123, P-127 and after, the dump solenoid is actuated by the dump switch only, while the vacuum solenoid is actuated by the landing gear safety switch. The safety valve functions the same as the differential control section of the differential control valve except that the pressure setting is slightly higher.

A solenoid valve is also located on the differential control valve. The primary function of this solenoid is to eliminate pressurization fluctuation during ground run-up and flight in the unpressurized mode. When energized, the solenoid valve allows vacuum to be applied to the control diaphragm which holds it in the open position allowing cabin pressure to freely dump overboard. The solenoid valve is energized when the manual dump switch is in the dump position or any time the airplane is on the ground. The vacuum source is an ejector, located in the aft fuselage which obtains its air supply from the instrument air or deicer system.

PRESSURIZATION TEST SWITCH

A pressurization press-to-test switch is located on the RH subpanel. The press-to-test switch de-energizes the solenoid valves on the differential control valve and the safety valve so the pressurization system can be checked during ground run-up. Pressurization ground check may be accomplished as follows:

a. Place the manual dump switch in the pressure position and the firewall shut-off valves in the open position.

b. Run the engines at 2,000 rpm and press the press-to-test switch.

c. A momentary indication of a descent in cabin altitude on the cabin rate-of-climb indicator shows that the system will pressurize.

PRESSURIZATION CONTROL - DESCRIPTION AND OPERATION (P-308 AND AFTER)

The pressurization control system consists of a system mode switch, cabin altitude controller, auxiliary volume tank, outflow valve and safety valve. The system mode switch has three positions, TEST, NOR (normal) and DUMP, to permit the operation of the system in the ground test, pressurized flight and unpressurized flight modes.

The controller contains a visual display of the selected altitude, an altitude selector and a rate control. The outer scale of the selected altitude visual display indicates the selected cabin altitude, the inner scale indicates the corresponding altitude at which the maximum differential pressure would occur. The rate control regulates the rate at which cabin pressure ascends or descends to the selected altitude. When the pointer of the rate control knob is set to the 12 o'clock position, the rate of change is approximately 500 feet per minute.

The outflow valve and the safety valve are mounted within a box structure which is a portion of the aft pressure bulkhead. Each valve consists of two sections, a head and a base section. Within the head section of each valve, is a control chamber. The control chamber of the outflow valve is closed except for the pneumatic fitting, designated port "2", which connects the control chamber to the reference pressure developed in the cabin altitude controller. The control chamber of the safety valve is connected to the airplane vacuum system through port "2" and is vented to the cabin air through a filter and orifice. A differential control assembly mounted on the head section of each valve is vented to static atmosphere through the pneumatic fitting designated port "1". The base section of each valve houses the poppet valve, poppet valve seat and noise suppression screen. The poppet valves are spring loaded to the closed position whenever there is no controlling pressure applied.

The following description of the system operation is made, assuming that the system is functioning normally, both engines are operating, bleed air from the turbochargers is flowing normally and the airplane vacuum system is functioning.

Prior to a normal pressurized flight, with the system switch placed in the NOR (normal) position, electrical power is routed to a ram air door magnetic latch and, through a portion of the RH landing gear safety switch, to actuate a pair of solenoid air valves. One, a normally closed air valve, is actuated to open and permit the application of a negative pressure from the airplane vacuum system to the control chamber of the safety valve. The safety valve poppet valve is thus opened to prevent pressurization of the airplane. The second solenoid air valve, a normally open valve, is energized to close the supply line to the cabin altitude controller, permitting it to be preset to the desired cabin altitude, prior to take-off for the flight.

When the airplane leaves the ground, the contacts of the RH safety switch change over, thus, opening the coil circuits of the solenoid valves. The normally closed air valve closes to remove the safety valve control chamber from the airplane vacuum system. Cabin air enters the control chamber of the safety valve through a filter and orifice. This permits the poppet valve return spring to close the poppet valve. Simultaneously, the normally open air valve opens, thus, connecting the cabin altitude controller to the airplane vacuum system. The controller pre-rates to the selected cabin altitude. If the cabin altitude is above the field elevation, the outflow valve poppet valve will modulate open, preventing pressurization of the airplane until the selected altitude is reached. As the airplane reaches the selected cabin altitude, the reference pressure developed within the cabin altitude controller decreases, permitting the outflow valve poppet valve to modulate toward the closed position, thus, restricting the outflow of cabin air. The outflow valve poppet valve will modulate to restrict the outflow of cabin air as required to maintain the selected altitude.

If the flight plan requires an airplane altitude greater than the altitude indicated on the inner scale of the visual display of selected cabin altitude, the airplane cabin will be pressurized at the maximum differential pressure. At this time the differential pressure across the differential pressure control diaphragm assemblies of the safety valve and the outflow valve will cause these valves to modulate open, maintaining the maximum differential pressure of the airplane. As the airplane continues to climb the cabin altitude will climb at the same rate of climb as the airplane climbs.

NOTE

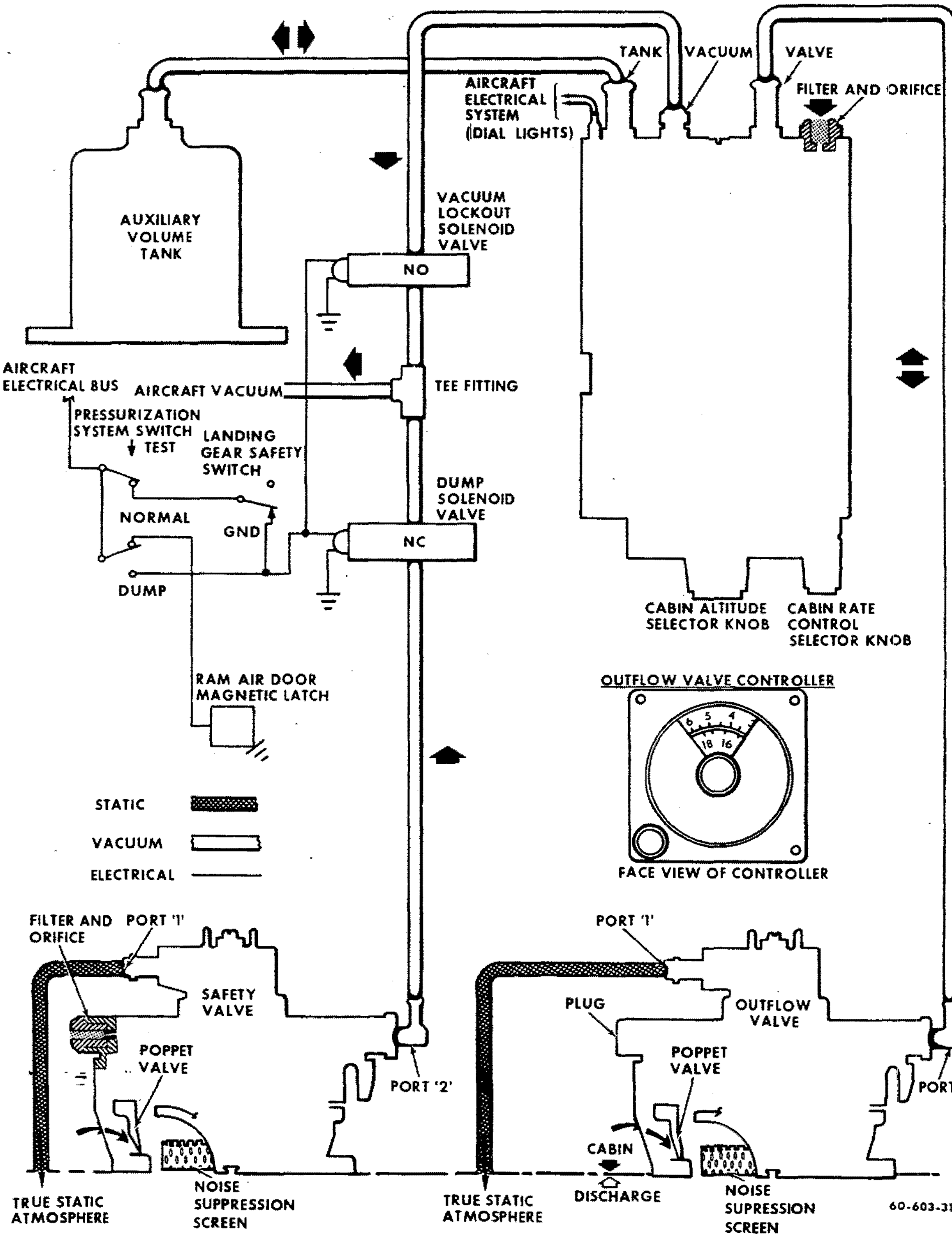
> During a rapid rate of airplane assent, if the cabin rate selector is set at a low rate, the maximum differential pressure could be achieved prior to reaching the selected airplane altitude.

If the cabin altitude is greater than the selected cabin altitude and the airplane decends, the cabin altitude will decend at the selected cabin rate until the selected cabin altitude is achieved.

Should there be a loss of cabin airflow from the turbochargers and the airplane decends to an altitude where the atmospheric pressure exceeds the cabin pressure, a negative pressure differential will exist across the inner diaphragms of both the outflow valve and the safety valve. When the control chamber-to-atmosphere pressure differential is sufficient to overcome the force of the poppet valve return springs, the poppet valves will open permitting air at atmospheric pressure to flow into the cabin counteracting the negative pressure differential.

Depressurizing the cabin for emergencies, such as smoke in the cabin, may be accomplished by placing the mode select switch in the DUMP position. The normally closed solenoid air valve opens to connect the control chamber of the safety valve to the airplane vacuum system. The safety valve poppet valve is thus opened, permitting the cabin air flow to exhaust to the atmosphere without restriction.

When the airplane touches down after a pressurized flight, the actuation of the RH landing gear safety switch will again energize the two solenoid air valves to open the safety valve poppet valve and to block the source of vacuum from the cabin air controller.



Cabin Pressure Control System Schematic
(P-308 and after)
Figure 4

"END"

PRESSURIZATION CONTROLS - MAINTENANCE PRACTICES (P-3 THRU P-307)

CABIN ALTITUDE CONTROLLER FILTER (MOTORIZED)

A cabin altitude controller filter is utilized on Duke serials P-229 and after, and those prior airplane's which have complied with Service Instructions 0528-453 that have the optional motorized cabin altitude controller installed.

The filter is designed to improve filtration and prevent the poppet valve from sticking due to tobacco tars and other contaminents. Under normal operating conditions the average life of the filter is 1,000 hours. This will vary according to extremes in cabin smoke density. An indication of need for filter replacement would be a slow response to variations in altitude.

DIFFERENTIAL CONTROL VALVE AND SAFETY VALVE REMOVAL

a. Remove the upper and middle upholstery panels from the forward side of the aft lower pressure bulkhead making the valve accessible. On airplane serials, P-247 and after, remove the plate which is attached by two AN4-5A bolts and sixteen AN3-5A bolts, to gain access to the differential control valve and the safety valve.

b. Loosen and remove all necessary plumbing from the valve. Cap open plumbing to keep shop soil, dirt and foreign objects from entering.

c. Remove the access door on the lower LH fuselage, just aft of the rear pressure bulkhead.

d. Station a man inside the aft fuselage to remove the six attaching bolts and remove the valve.

DIFFERENTIAL CONTROL VALVE AND SAFETY VALVE INSTALLATION

a. Station a man inside the aft fuselage to position the valve and install the six attaching bolts.

NOTE

Tighten the attaching bolts to a torque of 15 inch-pounds.

b. Remove the caps and install all plumbing to the valves.

NOTE

Tighten the differential control valve ELBOW or the safety valve TEE fitting to 50 ± 10 inch-pounds and secure with safety wire.

c. On airplane serials P-247 and after; install the plate over the differential control valve and the safety valve. Secure it with the two AN4-5A bolts, top and bottom, and sixteen AN3-5A bolts. Tighten the bolts evenly to a torque of 50 to 70 inch-pounds for the AN4-5A bolts, and 20 to 25 inch-pounds for the AN3-5A bolts.

WARNING

The airplane must not be pressurized prior to installation of the plate.

d. Install the access door on the lower LH fuselage.

e. Reinstall the upholstery panel.

DIFFERENTIAL CONTROL VALVE AND SAFETY VALVE ADJUSTMENT

NOTE

Check the differential control valve and safety valve for adjustment every 300 hours or annually.

The differential control valve and safety valve adjustments may be made in accordance with PRESSURIZATION SYSTEM ADJUSTMENT PROCEDURES. For information relating to overhaul and cleaning procedures, refer to Component Maintenance Manual, P/N 60-590001-27.

PRESSURIZATION SYSTEM ADJUSTMENT PROCEDURES

a. Remove the middle upholstery panels from the aft pressure bulkhead to provide access to the differential control valve and safety valve.

b. Open the bleed control valve 1-1/4 turns counterclockwise.

c. Preset the cabin altitude controller to the nearest index mark above field altitude. (Minimum of 1,000 feet.)

d. Adjust the dashpot spring to position the diaphragm approximately 0.45 inch from valve mounting face surface.

e. Check ram air door for resistance to opening by pushing with a long stiff rod with pressurization switch in pressurization mode and power on.

f. Cabin bleed-off rate at 4.6 psi should not exceed 6,000 fpm. (Required only if excessive leak rate is suspected.)

g. Execute a normal take-off and record maximum cabin descent which occurs approximately 20 seconds after lift-off. Acceptable range is 300 to 1,000 fpm.

h. Place the airplane in a 1,000 fpm climb at normal climb power and record maximum cabin descent as the airplane begins to pressurize. Maximum descent rate is 500 fpm.

i. After climbing through an altitude 2,000 feet above the altitude selected on the cabin altitude controller, adjust the bleed control valve (if required) as follows:

1. If the cabin climbs as the airplane climbs, close the bleed control valve to obtain a zero rate-of-climb on the cabin rate-of-climb indicator.

NOTE

Because of the sensitivity of the pressurization control system, the bleed control valve should be moved in increments of no more than 1/8 turn.

2. If the cabin dives as the airplane climbs, OPEN the bleed control valve to obtain a zero rate-of-climb on the cabin rate-of-climb indicator.

j. Level the airplane at an altitude approximately 8,000 feet above the selected cabin altitude and compare the selected altitude on the controller with the indicated cabin altitude on the cabin altimeter. If the difference in the two altitudes is in excess of 500 feet, the control head on the cabin altitude controller should be removed and adjusted to correspond with the altitude on the cabin altimeter.

NOTE

The manual controller should be removed from the subpanel prior to take-off if the need for adjustment is anticipated.

k. After landing, if lift-off descent is excessive and isobaric descent is small, as recorded in steps "g." and "h.", adjust the dashpot clockwise approximately 1/2 turn for each 400 fpm. Maximum clockwise adjustment is one turn.

l. If lift-off descent is small and isobaric descent is excessive, as recorded in steps "g." and "h.", adjust the dashpot counterclockwise approximately 1/2 turn for each 400 fpm.

m. Reinstall the upholstery panels to the aft pressure bulkhead.

CABIN ALTITUDE CONTROLLER REMOVAL (MANUAL)

a. Remove the four attaching screws at the subpanel.

b. Loosen and remove plumbing from the controller. Cap open plumbing to keep shop soil, dirt and foreign objects from entering.

c. Remove the controller.

CABIN ALTITUDE CONTROLLER INSTALLATION (MANUAL)

a. Remove plumbing cap and install plumbing to controller.

b. Position the controller in the subpanel.

c. Install the four attaching screws at the subpanel.

CABIN ALTITUDE CONTROLLER ADJUSTMENT (MANUAL)

a. Make a reference mark on the outer ring of the controller control head to match the triangular mark on the edge light panel directly above the control.

b. Remove the controller from the subpanel.

NOTE

The controller should be removed from the subpanel prior to take-off if the need for adjustment is anticipated.

c. Loosen the control head retention Allen screw and slide the control head off the bellows shaft without turning the shaft.

NOTE

Do not loosen the slot head screw in the knob on the control head.

d. Hold the outer ring of the control head and rotate the cabin altitude selection knob until the actual cabin altitude, as indicated on the cabin altimeter, aligns with the reference mark (see step "a.").

e. Align the guide pin and slide the control head back on the bellows shaft without turning the shaft.

f. Secure the control head in place with the Allen screw and reinstall the controller in the subpanel.

For proper information relating to overhaul and cleaning procedures refer to Component Maintenance Manual, P/N 60-590001-27.

CABIN ALTITUDE CONTROLLER REMOVAL (MOTORIZED)

a. Remove the four attaching screws at the subpanel.
b. Remove the screw, washer and support clamp, located behind the subpanel, from the controller.
c. Loosen and remove plumbing from the controller. Cap open plumbing to keep shop soil, dirt and foreign objects from entering.
d. Remove the controller.

CABIN ALTITUDE CONTROLLER INSTALLATION (MOTORIZED)

a. Remove plumbing cap and install plumbing to controller.
b. Position the controller in the subpanel.
c. Install the support clamp on the controller and attach with the screw and washer.
d. Install the four attaching screws at the subpanel.

CABIN ALTITUDE CONTROLLER ADJUSTMENT (MOTORIZED)

NOTE

The controller does not need to be removed from the subpanel for this adjustment.

a. Loosen the control head retention Allen screws and slide the control head off the bellows shaft without turning the shaft.

NOTE

Do not loosen the slot head screw in the knob on the control head.

b. Rotate the control head until the altitude in the 12 o'clock position on the selection knob is the same as the actual cabin altitude, as indicated on the cabin altimeter.
c. Align the guide pin and slide the control head back on the bellows shaft without turning the shaft.

CAUTION

Incorrect positioning of the control head on the bellows shaft may cause improper travel clearances and result in damage to the slip clutch.

d. Tighten the Allen screws to secure the control head on the bellows shaft.

For proper information relating to overhaul and cleaning procedures refer to Component Maintenance Manual, P/N 60-590001-27.

PRESSURIZATION TEST PROCEDURE

(Refer to "1.a." and "1.b." under TROUBLESHOOTING PRESSURIZATION SYSTEM.

This test provides a means of isolating the cabin altitude control to determine if it or the differential control valve is defective when the system cannot be properly pressurized.

a. Remove the upholstery panels providing access to the differential control valve at the aft pressure bulkhead.
b. Disconnect the cabin altitude control sense line from the differential control valve.
c. Pull the pressurization control circuit breaker.
d. Start both engines and VERY SLOWLY increase power to a minimum of 20 in. Hg manifold pressure (cabin rate-of-descent not to exceed 1,000 feet per minute).

WARNING

Increasing power rapidly could cause the cabin to pressurize to maximum differential within a short time, to the subsequent discomfort of personnel in the airplane.

e. If the cabin rate-of-climb indicator shows a descent as power is increased above a minimum of 20 in. Hg manifold pressure, the cabin altitude control is defective.
f. If the cabin rate-of-climb does not show a descent as power is increased above a minimum of 20 in. Hg manifold pressure, the isobaric control portion of the differential control valve is defective. The differential control portion of the valve may also be checked by allowing the cabin to pressurize to maximum differential pressure. If cabin pressure stabilizes at 4.6 to 4.7 psi as monitored by the cabin differential pressure gage, the differential control portion of the valve is functioning properly.
g. SLOWLY decrease power until the cabin is depressurized, then shut down both engines.
h. If any components were found defective, replace them and repeat the test.
i. Reset the pressurization control circuit breaker.
j. Reconnect the cabin altitude control sense line to the differential control valve, then reinstall the upholstery panels on the aft pressure bulkhead.

PRESSURIZATION CONTROL - MAINTENANCE PRACTICES (P-308 AND AFTER)

OUTFLOW VALVE AND SAFETY VALVE REMOVAL

The safety valve and the outflow valve are nearly identical. The safety valve is installed in the lower position and the outflow valve is installed in the upper position.

a. Remove the upholstery panel from the aft pressure bulkhead.
b. Remove the plate to gain access to the outflow and safety valves. The plate is secured with two AN4-5A bolts and sixteen AN3-5A bolts.
c. Loosen and remove the plumbing, as necessary, to permit removal of the valve. Tag the plumbing as removed to facilitate reinstallation. Cap all open plumbing and valve fittings to prevent shop soil and foreign objects from entering.
d. Remove the access door on the lower LH fuselage, just aft of the rear pressure bulkhead.
e. Station a man inside the aft fuselage to remove the six attaching nuts and washers securing each valve.
f. Remove the valve.
g. Remove and discard the old gasket.

OUTFLOW VALVE AND SAFETY VALVE INSTALLATION

a. Remove all traces of the old gasket.
b. Station a man inside the aft fuselage to install the attaching washers and nuts that secure each valve.
c. Install the safety valve in the lower position and/or the outflow valve in the upper position, using a new gasket.
d. Secure the valve to the pressure bulkhead structure by installing a washer and a nut at each of the six plates. Tighten the nuts evenly to a torque of 4 ± 1 inch-pounds.

NOTE

Earlier airplane serials have valves with flared fittings, while later serials, equipped with plastic outflow valves, use a beaded tube fitting and clamps to secure the plumbing. Use water only as a lubricant on EVA tubing being installed over beaded tubing or fittings.

e. Remove the caps and install the plumbing as tagged when the plumbing was removed.
f. Install the plate over the outflow and safety valves. Secure it with the two AN4-5A bolts, at top and bottom, and the sixteen AN3-5A bolts. Tighten the bolts evenly to a torque of 50 to 70 inch-pounds for the AN4-5A and 20 to 25 inch-pounds for the AN3-5A bolts.

WARNING

The airplane must not be pressurized prior to installation of the plate.

g. Reinstall the access door on the lower LH fuselage, aft of the rear pressure bulkhead.
h. Reinstall the upholstery panel.

OUTFLOW VALVE AND SAFETY VALVE ADJUSTMENT

The outflow valve and the safety valve are each preset at the factory to regulate the cabin pressurization to a maximum differential pressurization of 4.6 ± .1 psi. Field adjustment of these valves is not recommended. In the event of a malfunction, the valves should be returned to Beech Aircraft Corporation in exchange for an Overhauled Exchange unit.

OUTFLOW AND SAFETY VALVE CLEANING

CAUTION

The outflow and safety valves are preset at the factory and field adjustment is not recommended. Any time the valve seal is broken, the WARRANTY (6 months in duration) is VOIDED.

Fluctuation of cabin pressure often indicates dirty outflow and safety valves. The seats of these valves should be cleaned at 100 hour inspections, or more frequently if needed. The inspection and cleaning of the valve seat and bellows may be accomplished by the following suggested procedure:

a. Remove the aft fuselage access panel from the lower LH fuselage aft of the aft pressure bulkhead.
b. Compress the bellows to permit inspection and cleaning.
c. Clean the bellows and the inner rim of the valve housing where the bellows contacts the housing when the bellows is extended, using a clean rag dampened with isopropyl alcohol (45, Chart 207, 91-00-00).

SAFETY VALVE FILTER AND ORIFICE CLEANING

The filter and orifice in the head section of the safety valve should be removed, cleaned and inspected every 1,000 hours. The filter may be cleaned by the following suggested procedure:

a. Remove the upholstery panel.
b. Remove the plate to gain access to the safety valve. The plate is secured with two AN4-5A bolts and sixteen AN3-5A bolts.
c. Remove the filter from the head section of the safety valve. Do not lose the packing.
d. Remove the retaining ring from the filter assembly housing. Remove one screen, the copper ribbon and the remaining screen from the housing of the filter assembly.
e. Wash both screens, the copper ribbon, and the filter assembly housing in solvent (15, Chart 207, 91-00-00). Ensure that the orifice of the filter housing is free of foreign material.
f. Install one screen in the housing of the filter assembly. Install the copper ribbon in the filter assembly housing. Do not over compress the ribbon. Install the remaining screen and secure the filter in the housing using the retaining ring.
g. Install the filter assembly in the safety valve, using the packing removed with the filter assembly. Tighten to a torque of 15 to 20 inch-pounds.
h. Reinstall the plate over the outflow and safety valves. Secure it with the two AN4-5A bolts, at top and bottom, and the sixteen AN3-5A bolts around the perimeter of the plate. Tighten the bolts evenly to a torque of 50 to 70 inch-pounds for the AN4-5A bolts and 20 to 25 inch-pounds for the AN3-5A bolts.

WARNING

The airplane must not be pressurized prior to installation of the plate.

i. Reinstall the upholstery panel.

FUNCTIONAL TEST OF OUTFLOW VALVE AND SAFETY VALVE (P-308 and after)

OUTFLOW VALVE FLIGHT CHECK

The following check must be accomplished with the airplane in flight.

a. If the cabin pressure can be controlled at 1/2 psid (pounds per square inch differential) less than maximum differential of 4.6 $\pm$ .1 psi, the outflow valve is operating satisfactorily.
b. If the cabin pressure goes to maximum differential and cannot be controlled at 1/2 psid below maximum differential, the outflow valve must be replaced.
c. The outflow valve is removed and installed as described in this Chapter under the headings OUTFLOW VALVE AND SAFETY VALVE REMOVAL and OUTFLOW VALVE AND SAFETY VALVE INSTALLATION.

SAFETY VALVE GROUND CHECK

a. Connect a regulated cabin pressurization test unit to the airplane as outlined under the heading CABIN PRESSURIZATION LEAKAGE TEST (P-4 and after) in this Chapter. (Do not pressurize at this time.)
b. Working through the access opening behind the aft pressure bulkhead, locate the line that connects the dump solenoid valve to the safety valve and disconnect the line from the solenoid valve.
c. Connect a regulated vacuum source to the line which was disconnected from the solenoid valve. (Do not apply vacuum at this time.)
d. Pressurize the cabin to 3 psid.
e. Slowly apply regulated vacuum to the safety valve. If the valve opens before the vacuum reaches 4 inches Hg indication on the test unit, the valve is operating satisfactorily. If more than 4 inches Hg are required to open the safety valve, the valve must be replaced.

CABIN ALTITUDE CONTROLLER REMOVAL

a. Remove the knobs, handles, screws, etc. to facilitate the removal of the edge-lighted panel from the RH inboard subpanel.
b. Tag the plumbing as removed to facilitate reinstallation. Loosen and remove all plumbing from the cabin pressurization controller, as necessary to permit removal of the controller. Cap all open plumbing to keep shop soil and foreign material from entering the plumbing and the controller. Disconnect the electrical wiring from the controller lamp wires.
c. Remove the three screws securing the cabin altitude controller to the printed circuit board of the RH inboard subpanel.
d. Remove the cabin altitude controller.

CABIN ALTITUDE CONTROLLER INSTALLATION

a. Install the cabin altitude controller in the printed circuit board of the RH inboard subpanel. Secure with the three screws.
b. Remove the caps and reinstall the plumbing as tagged during removal. Reconnect the wiring to the controller lamps.

c. Install the edge-lighted panel. Secure with the screws. Replace the knobs and handles.

CABIN PRESSURIZATION CONTROLLER ADJUSTMENT

The cabin pressurization controller is preset at the factory. Field adjustments and maintenance of the controller is not recommended. In the event of a malfunction, the cabin pressurization controller should be returned to Beech Aircraft Corporation in exchange for an Overhauled-Exchanged unit.

CABIN ALTITUDE CONTROLLER FILTER AND ORIFICE CLEANING

The filter and orifice in the cabin altitude controller should be removed, cleaned, and inspected every 500 hours. The filter may be removed and cleaned by the following suggested procedure:

a. Remove the filter assembly from the housing of the cabin altitude controller. Do not lose the packing.
b. Remove the retaining ring from the filter assembly housing. Remove one screen, the copper ribbon and the remaining screen from the housing of the filter assembly.
c. Wash both screens, the copper ribbon and the filter assembly housing in solvent (15, Chart 207, 91-00-00). Ensure that the orifice of the filter housing is free of foreign material.
d. Install one screen in the housing of the filter assembly. Install the copper ribbon in the filter assembly housing. Do not over compress the copper ribbon. Install the remaining screen and secure the filter in the housing using the retaining ring.
e. Install the filter assembly in the cabin altitude controller using the packing removed with the filter assembly. Tighten to a torque of 15 to 20 inch-pounds.

AUXILIARY VOLUME TANK REMOVAL

a. Loosen and remove the plumbing. Cap the plumbing and the auxiliary volume tank to prevent shop soil, dirt and foreign material from entering the auxiliary volume tank or the plumbing.
b. Remove the two screws securing the auxiliary volume tank to the forward cabin pressurization bulkhead. Remove the tank.

AUXILIARY VOLUME TANK INSTALLATION

a. Mount the auxiliary volume tank on the forward cabin pressure bulkhead and secure with the two screws previously removed.
b. Remove the caps and connect the plumbing to the auxiliary volume tank.

PRESSURIZATION TEST PROCEDURE (P-308 AND AFTER)

The pressurization system may be functionally checked for operation by the following suggested procedure:

a. If the outflow valve and the safety valve are to be tested for proper differential pressure operation, proceed as follows:

1. Remove the upholstery panel from the aft pressure bulkhead. Remove the access plate to gain access to the outflow valve and safety valves.
2. Loosen and remove the plumbing from the true static air vent (port 1) on the head section of each valve. (Tag each tube to facilitate reinstallation.) Add a section of tubing to each static air vent of sufficient length to reach through the holes in the access plate after it has been reinstalled, since the airplane must not be pressurized prior to installation of the plate. Provide a means of disconnecting and capping each true static air vent with the plate reinstalled. Tag each tube for identification during the test.
3. Reinstall the plate. Secure the plate and tighten the bolts evenly to a torque of 50 to 70 inch-pounds for the AN4-5A bolts at the top and bottom of the plate and 20 to 25 inch-pounds for the remaining bolts.

WARNING

The airplane must not be pressurized prior to installation of the plate.

b. Close and secure the cabin door.
c. Rotate the cabin rate control selector knob to the 12 o'clock position.
d. Select a cabin altitude that is approximately 500 feet above the field elevation.
e. Set the airplane brakes and start the engines as instructed in the applicable Duke Pilot's Operating Manual. Operate both engines at a minimum power setting of 20 in. Hg manifold pressure to establish a steady flow of cabin air.
f. Open the pressurization system circuit breaker. Note that the safety valve on the aft pressure bulkhead closes and the airplane starts to pressurize.
g. Select a cabin altitude that is approximately 1,500 feet below the field elevation. The cabin will pressurize at a rate-of-change rate to decrease the cabin altitude.

h. Rotate the rate control selector knob counterclockwise and note a reduction in rate-of-change of cabin pressurization.

i. Rotate the rate control selector knob clockwise and note a reduction in the rate-of-change of cabin pressurization.

j. Rotate the cabin altitude selector knob to the full counterclockwise stop and select a rate-of-change that is comfortable. The cabin-to-atmosphere pressure differential will increase. The value of the differential pressure attained will depend upon the field elevation at which the test is conducted.

k. When the cabin pressure has stabilized, disconnect and cap the plumbing from the cabin pressurization controller port labeled VACUUM. Cap the plumbing and the controller port to prevent the entrance of foreign materials.

The cabin-to-atmosphere pressure differential will now increase to the normal positive differential pressure setting of the outflow valve and the safety valve.

NOTE

Cabin pressure will increase to the maximum differential value at an uncontrolled rate when the vacuum line is disconnected.

l. After the cabin pressure has again stabilized, note the readings on the CABIN ALT and DIFF PRESS indicator.

m. Disconnect the true static air vent which is connected to the outflow valve. (Refer to step "a." of this procedure.) The DIFF PRESS indicator shall indicate a change that is no greater than .1 psi.

n. Reconnect the static air vent to the outflow valve and disconnect and cap the true static air vent from the safety valve. The DIFF PRESS indicator should again indicate a change that is not greater than .1 psi. Reconnect the safety valve true static air vent.

o. Reconnect the plumbing to the VACUUM fitting of the cabin pressurization controller. The cabin altitude will return to the altitude selected on the cabin pressurization controller. The cabin altitude, as indicated on the CABIN ALT indicator, should stabilize at an altitude within 500 feet of the selected cabin altitude.

p. Rotate the cabin altitude selector to select an altitude that is approximately 500 feet above the field elevation. After the cabin altitude has again stabilized, reset the cabin pressurization circuit breaker. Shut down the engines as described in the applicable Duke Pilot's Operating Manual.

q. Remove the plate over the outflow and safety valves. Remove the test plumbing installed in step "a.", above. Reconnect the true static air vent tubes to the outflow valve and the safety valve. Reinstall the plate. Tighten the bolts evenly to a torque of 50 to 70 inch-pounds for the AN4-5A bolts at the top and bottom of the plate and 20 to 25 inch-pounds for the remaining bolts.

WARNING

The airplane must not be pressurized prior to installation of the plate.

r. Reinstall the upholstery panel.

CABIN PRESSURIZATION LEAKAGE TEST (P-4 and after)
(Figure 201)

Test equipment is available for ground testing the cabin for pressurization leaks and for troubleshooting the pressurization system. Such equipment must be capable of delivering 4.50 psi of air at 80 cubic feet per minute and must be protected by a complete safety system to prevent damage to the airplane. The test unit listed in the following paragraph consists of an electric motor and blower assembly, a dry air filter, a flowmeter, a cabin pressure gage, and a large relief valve to protect the pressure vessel of the airplane.

NOTE

It should be noted that the test unit to be used must be set at the psi of pressurization for which the airplane is designed if the safety system of the test unit is to fulfill its function.

The units listed in the following paragraph, TEST EQUIPMENT, also include a pneumatic air system that delivers from zero to 30 pounds of air at 25 cubic feet per minute for checking the deicer boot system, and pressure instruments.

TEST EQUIPMENT (P-4 and after)

The following pressurization test units, or their equivalent, may be utilized for the cabin pressurization leakage test.

a. Cabin Pressurization Test Unit: Manufactured by Kitco Tool and Die Inc., 21 Water Street, Mill Hall, PA. 17751.

1. Model 1200 - for domestic use.
2. Model 1300 - for export use.

NOTE

The test equipment hoses, furnished with the test unit, may be connected in only one (either), or both nacelles. The TEST EQUIPMENT text and Figure 201 illustrates the test equipment hoses connected in both nacelles.

b. Use low pressure hose, 2 1/2 inches in diameter, to connect the PRESSURIZING AIR fitting of the test unit to the flexible ducts, forward of the LH and RH firewall's.

c. Two pieces of 1/4-inch high pressure hose is used to connect the PNEUMATIC AIR fitting on the test unit to the pneumatic line in each nacelle, forward of the pressure regulator.

d. High pressure hose, 3/8-inch in diameter, connects the INSTRUMENT AIR or CABIN PRESSURE fitting on the test unit to the brake reservoir sense line at the forward pressure bulkhead, located in the nose baggage compartment.

e. Tee or Y-shaped fittings and clamps to connect the hoses as described in steps "b" through "d".

f. High strength webbing or restraining straps to encompass fuselage doors and windows for safety of testing personnel during performance of test. (P/N 60-000000-D939-1 or equivalent.)

TEST PROCEDURE (P-4 and after)

a. Gain access to the outflow and safety valves at the aft pressure bulkhead. Remove the control port tubing from both the outflow and safety valves.

b. Connect the 3/8-inch high pressure hose from the INSTRUMENT AIR or CABIN PRESSURE fitting on the test unit to the brake reservoir sense line at the forward pressure bulkhead, located in the nose baggage compartment. The air supply must be capable of maintaining 4.50 psi.

NOTE

Ensure that all windows and doors are closed and securely latched.

WARNING

Personnel who work under pressurized conditions must be carefully chosen. Pressurization may prove dangerous to personnel which are overweight, have heart or respiratory disorders, ear infection, or are not emotionally stable.

c. Place high strength webbing, P/N 60-000000-D939-1 or equivalent in position over the pressure vessel (doors and windows).

d. Connect a 2-1/2 inch air supply hose between the test unit (PRESSURIZING AIR fitting) and the flexible ducts, forward of the LH and RH firewall.

e. Connect the PNEUMATIC AIR fitting on the test unit to the pneumatic line in each nacelle, forward of the pressure regulator.

NOTE

Ensure that all connections are secure at the airplane and at the test unit. Ensure that all "T" and/or "Y" fittings are secure.

f. Slowly open the air valve to pressurize the cabin. Monitor the RATE-OF-CLIMB and CABIN PRESSURE indicators. The rate-of-climb should not exceed 1,000 feet per minute to a maximum of 25,000 feet. The cabin differential pressure shall not exceed 4.6 ±-.1 psi as observed on the CABIN PRESSURE indicator.

g. Pressurize the cabin to a differential pressure of 4.00 ± .50. Allow five minutes for the cabin pressure to stabilize. After stabilization is established, check the cabin for excessive leakage. A 38 cubic feet per minute leakage is permissible. If the leakage is indicated at more than 38 cubic feet per minute, isolate the cause and repair as described in the following paragraphs.

1. Check all connections to the pressure vessel, test unit, and the "T" and/or "Y" fittings in the test hoses to ensure that no leaks exist. Repair all leaks and repeat steps "f." through "g."

2. If leaks through the outflow or safety valves are suspected, a slight adjustment of the outflow and safety valve mounting screws may reduce the leakage rate considerably. If the outflow and/or safety valves are determined to be defective, replace as necessary. Perform the leak test described in steps "f." through "g".

3. Check around the windows for leaks, remove and replace windows found to be defective.

NOTE

Ensure that the test unit is working properly and all gages are accurate.

4. Gain access to the points where the contrc cables, electrical wire bundles, plumbing, and landing gea

retract rods enter the pressure vessel by removing the seats, floorboards, and upholstery. Fill the control cable pressure seals with MIL-G-23827 grease (11, Chart 202, 12-20-00 and Chart 207, 91-00-00) and paint the control cables, through-out its full travel through the pressure seals with MIL-G-23827 grease (11, Chart 202, 12-20-00 and Chart 207, 91-00-00). Spread the electrical wire bundles apart and apply EC1239A½ sealant around each wire. After each wire is covered, wrap Scotch #33 vinyl around the wire bundle (butted against seal fitting) and inject EC1239A½ sealant in the notch of the seal fitting. Apply EC1239B½ sealant to all plumbing fittings at the pressure vessel. Ensure that the landing gear retract rods pressure boots are properly installed without damage. Perform the pressurization leak test as described in "a" through "g".

5. Remove all seats, floorboards, and upholstery panels. Check the complete pressure vessel for leaks. Isolate and repair all leaks. Repeat steps "a" through "g".

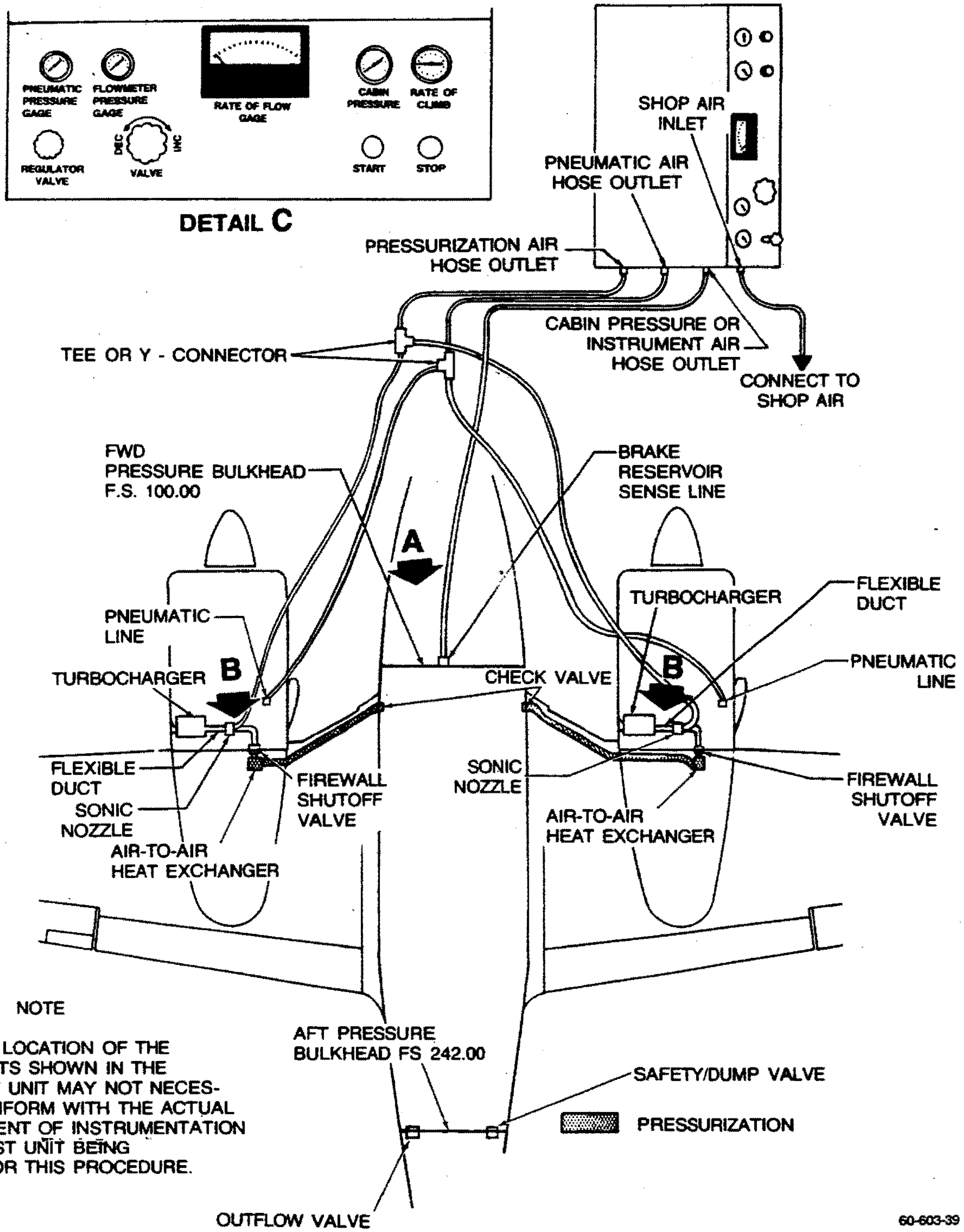
h. With the pressure leak test within tolerance, depressurize the pressure vessel and remove the safety net.

i. Remove all test hoses from the airplane and connect the hoses between the fuselage and the engines.

j. Install the control port tubing on each outflow and safety valves.

k. Remove the plug from the atmosphere port of the outflow valve and ensure that the back pressure test hose is removed from the atmosphere vent fitting of the safety valve (located on the aft side of the aft bulkhead).

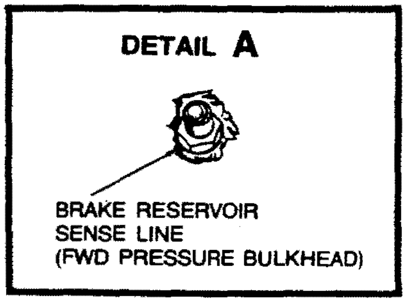
l. Install floorboards, upholstery panels, seats, and access panels which were removed during the test procedure.

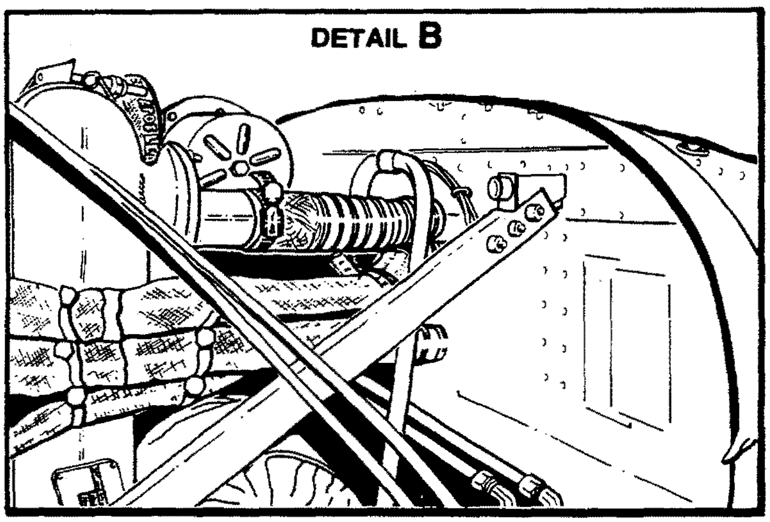


NOTE

THE EXACT LOCATION OF THE INSTRUMENTS SHOWN IN THE KITCO TEST UNIT MAY NOT NECESSARILY CONFORM WITH THE ACTUAL ARRANGEMENT OF INSTRUMENTATION ON THE TEST UNIT BEING UTILIZED FOR THIS PROCEDURE.

Cabin Pressurization Test Hookup (Page 1 of 2)
Figure 201





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Cabin Pressurization Test Hookup (Page 2 of 2)
Figure 202

"END"

HEATING - DESCRIPTION AND OPERATION

The heater system consists of a 45,000 BTU combustion air heater, (located under the nose baggage compartment floor), a six position mode switch, vent air blower, combustion air blower, heater fuel pump, five outlets, an automatic temperature control and three sensing elements.

In flight, when pressurized, the vent blower obtains air through the cabin air check valve, forces it through the heater and to the cabin outlets. In the unpressurized mode in flight and for ground operations, the vent blower obtains air from the cabin and the ram air plenum chamber and forces it through the heater and to the cabin outlets.

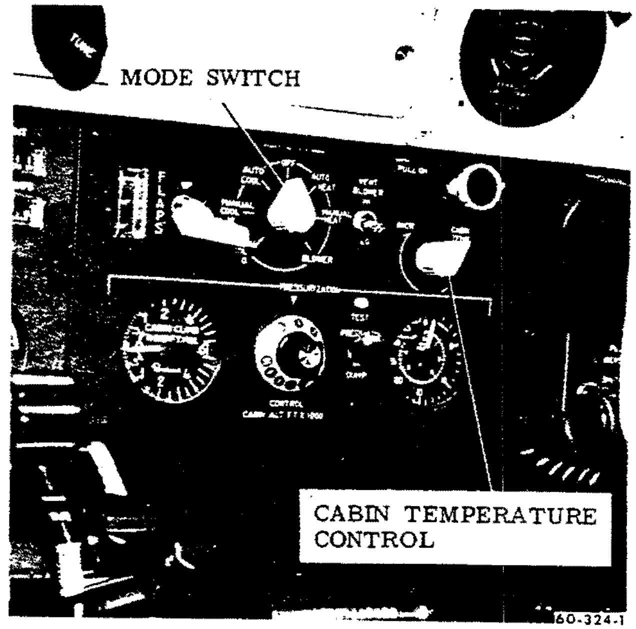
On serials P-4 through P-126, except P-123, a vent air distribution bypass valve, located on the forward pressure bulkhead, allows air to be directed into the pilot's compartment area and is regulated by a control knob on the pilot's left subpanel.

Exchanging the cabin air is accomplished by exhausting a controlled amount of air through the isobaric control valve on the aft pressure bulkhead.

HEATER CONTROL SYSTEM
(Figure 1)

The heater controls are located on the copilot's LH subpanel. Serials P-4 through P-126, except P-123, incorporates a six-position switch placarded; AUTO HEAT, MANUAL HEAT, BLOWER, AUTO COOL, MANUAL COOL, HI, MANUAL COOL LO, and OFF. On serials P-123, P-127 and after the mode selector switch differs slightly in that a MANUAL COOL position replaces the MANUAL COOL HI and MANUAL COOL LO positions. In addition, two blower positions are placed on the selector switch to allow the blower to be selected without cycling through the opposite mode. The mode switch controls both the heating and cooling systems; however, each system operates independently of the other. In the manual heat position, the switch bypasses the automatic cabin heat controls and allows maximum heat output. However, the heater output in the manual position is limited by a heater cycling switch. In the automatic heat position a temperature control rheostat placarded CABIN TEMP INCREASE can be set for the desired cabin temperature.

Outlet air velocity may be changed in either MANUAL HEAT or AUTO HEAT mode by moving the VENT BLOWER switch, located in the copilot's LH subpanel to either the HI or LO position.



Cabin Temperature Controls
Figure 1

HEATER OPERATION

a. To place the heating system in operation select an operational mode; either MANUAL HEAT or AUTO HEAT.

b. If the AUTO position is chosen, set the control rheostat for the desired heat. The heater is now set up for normal operation providing thermostatic temperature regulation.

c. If MANUAL heat control is desired or required by a malfunction in the AUTO system, move the switch to the MANUAL position. This removes the automatic controller and the sensing elements from the control system. The heater will then cycle continuously by the preset integral heater cycling switch.

d. The CABIN AIR control which regulates the amount of outside ram air to the cabin is located on the copilot's LH subpanel. Pull the CABIN AIR control full aft for maximum air. The CABIN AIR control is overridden when the cabin is pressurized.

e. For windshield defrosting, operate the heater in either the auto or manual mode and pull out the DEFROST control located on the pilot's LH subpanel.

f. Heated air is normally directed onto the pilot's feet. To shut off this air, pull out the PILOT AIR control located on the pilot's LH subpanel.

g. The COPILOT AIR control, identical to the PILOT AIR control is located on the copilot's RH subpanel.

NOTE

The volume of air available for the pilot outlet and copilot outlet can be divided between the two outlets as desired by adjusting each control individually. More heated air will be available for defrosting by reducing the flow of air from the pilot and/or copilot outlets.

If a malfunction resulting in dangerously high temperatures (300°F. to 400°F.) should occur, the heater over-temperature switch will lock out and blow either the over-temperature fuse (manual mode) or the over-temperature fuse (auto mode) in the heater power circuit. This renders the heater system, except the blower, inoperative. The over-temperature fuses are located behind the LH upper side panel. The heater over-temperature switch is located on the heater assembly. The switch must be manually reset during heater system servicing after an over-temperature condition has occured.

CAUTION

Make certain any malfunction causing an overheat condition is corrected before attempting to operate the heater.

For additional heat, the PRESSURIZATION AIR TEMI CONTROLS located on the copilot's RH subpanel can b pulled out to restrict cooling air flow through the cabin ai heat intercooler. For maximum heat in the unpressurize mode, push the CABIN AIR control full forward to sto the flow of incoming cold air.

NOTE

The intercooler doors should be closed during all heating operations to reduce the load on the heater. Conversely, the doors should be open to reduce load during all cooling operations.

"END"

HEATING - MAINTENANCE PRACTICES

HEATER REMOVAL

The heater should be removed from the aircraft and disassembled. All parts should be thoroughly inspected and necessary repairs and parts replacements made every 500 hours of operation.

The heater is removed as follows:

a. Remove the necessary nose baggage compartment floorboards to gain access to the heater.
b. Loosen the clamp and disconnect the duct from the combustion air blower.
c. Tag the wires and disconnect the wire harness from the heater.
d. Loosen the clamps around the fuel inlet line boot and slide the boot up the fuel line. Disconnect the fuel line from the heater.
e. Remove the safety wire and loosen the clamp on the heater exhaust shroud (located under the heater).
f. Remove the clamps, located at each end of the heater.
g. Lift the heater up and out of the aircraft.

HEATER INSTALLATION

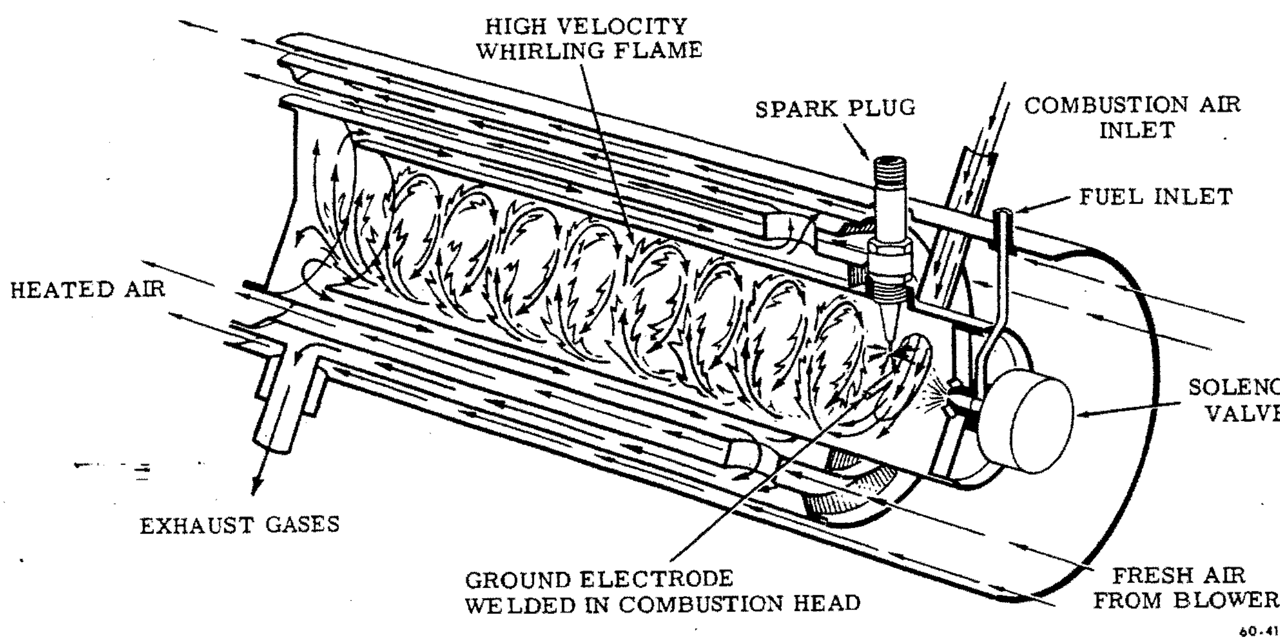
a. Position the heater in the aircraft taking care to guide the fuel drain through the grommet in the skin and the exhaust shroud through its opening.
b. Install the clamps at each end of the heater.
c. Position the clamp on the heater exhaust shroud located under the heater and secure and safety.
d. Install the fuel line to the heater. Slide the boot down the fuel line and secure the clamps around the boot.
e. Install the wire harness to the heater.
f. Connect the duct to the combustion air blower and secure the clamps.
g. Install the nose baggage compartment floorboards.

COMBUSTION AIR BLOWER REMOVAL

a. Remove the heater.
b. Tag the wires and disconnect the wiring from the combustion air blower and combustion air controller.
c. Loosen the clamps and disconnect the ducts on the combustion air blower.
d. Remove the attaching screws from the combustion air blower and the two controller mounting brackets.
e. Remove the combustion air blower and controller from the aircraft as a unit.

COMBUSTION AIR BLOWER INSTALLATION

a. Install the combustion air blower and controller in the aircraft as a unit.
b. Install the two controller mounting brackets and secure the combustion air blower with the attaching screws.
c. Install the ducts on the combustion air blower and secure with the clamps.
d. Install the wiring to the combustion air blower and



Aircraft Heater
Figure 201

combustion air controller.

e. Install the heater.

HEATER IGNITION

(Figure 201)

The controlled atomized spray from a specially designed spray nozzle, coupled with high-voltage spark plug ignition, insures instant firing and continuous burning under all flight conditions. Heat is produced by burning a fuel-air mixture in the combustion chamber of the heater. Aviation gasoline is injected into the combustion chamber through the spray nozzle. The resulting cone-shaped fuel spray mixes with combustion air and is ignited by a spark from the spark plug. Electric current for ignition is supplied by an ignition unit which converts 24 volts to a high-voltage, oscillating current to provide a continuous spark across the spark plug gap. A shielded, high voltage lead connects the ignition assembly to the spark plug. Combustion air enters the combustion chamber tangent to its surface and imparts a whirling or spinning action to the air. This produces a whirling flame that is stable and sustains combustion under the most adverse conditions because it is whirled around itself many times. Therefore, ignition is continuous and the combustion process is self-piloting. The burning gases travel the length of the combustion tube, flow around the outside of the inner tube, pass through cross-over passages into an outer radiating area, then travel the length of this surface and out the exhaust.

Ventilating air passes through the heater between the jacket and combustion tube assembly outer surface and through an inner passage in the assembly. Consequently, ventilating air comes into contact with two or more heated, cylindrical surfaces.

VIBRATOR REMOVAL

a. Remove the necessary access panels, in the nose compartment, to reach the ignition unit on the heater assembly.

NOTE

Measure the distance the vibrator protrudes out of the ignition assembly to determine when a new unit is inserted properly.

b. Grasp the vibrator and with a slight back and forth movement, pull it straight out of the ignition unit.

NOTE

For a friction grip, it may be necessary to use a piece of masking or friction tape around the exposed portion of the vibrator.

VIBRATOR INSTALLATION

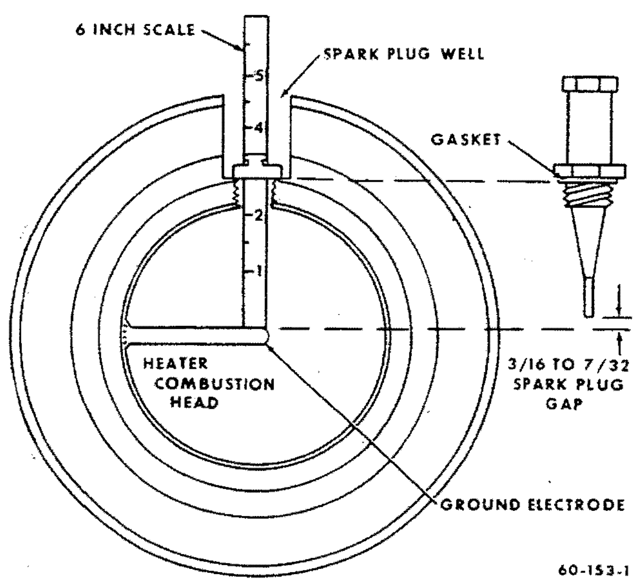
a. To install a new vibrator, carefully rotate the new vibrator until the index marks are aligned and the connector pins on the vibrator can be felt entering the pin sockets in the vibrator socket, then press the vibrator fully and firmly into position.

b. Check the heater for operation and close all access openings.

INSPECTION AND SERVICING (SPARK PLUG)

(Figure 202)

If the spark plug appears to be in good condition, except for a mild coating of oxide on the porcelain and electrodes, it may be cleaned and reused. Cleaning is accomplished on a conventional aircraft type spark plug cleaner, except that it will be necessary to use two or more adapters in order to raise the long extension of the plug far enough out of the cleaner nozzle opening to provide an effective job. Plug the ceramic insert cavity at the terminal end of the plug with a piece of paper or cloth to keep out any of the cleaning sand. Wipe this cavity out thoroughly with a cloth, wet with carbon tetrachloride. If, after cleaning, the spark plug porcelain is white, and the electrode is not eroded, the spark plug gap may be set as follows. Insert a six inch scale with a sliding clip into the spark plug well until it touches the ground electrode welded inside the combustion head. Withdraw the scale and note the dimension between the sliding clip and the end of the scale. Place the scale against the bottom of the spark plug gasket and determine the length of the spark plug positive electrode. The difference



Heater Spark Plug Gap
Figure 202

between the two measurements is the spark plug gap. The gap should be 3/16 to 7/32 (0.188 to 0.218) inches. If the plug gap must be adjusted, the ground electrode may be bent up or down by reaching through the spark plug hole with the appropriate shaped tool.

NOTE

If the spark plug fails to clean up properly and/or if the electrode is badly eroded, it should be replaced.

If a new spark plug is being installed, be sure to measure the gap. Do not bend the positive electrode. Torque the spark plug to 28 foot-pounds.

NOTE

The spark plug can be checked visually for sparking prior to installing the plug as follows: Disconnect the wire from the terminal on the heater wiring side of the terminal strip to de-energize the fuel solenoid valve. Connect the high-voltage lead temporarily and lay the spark plug on the heater jacket.

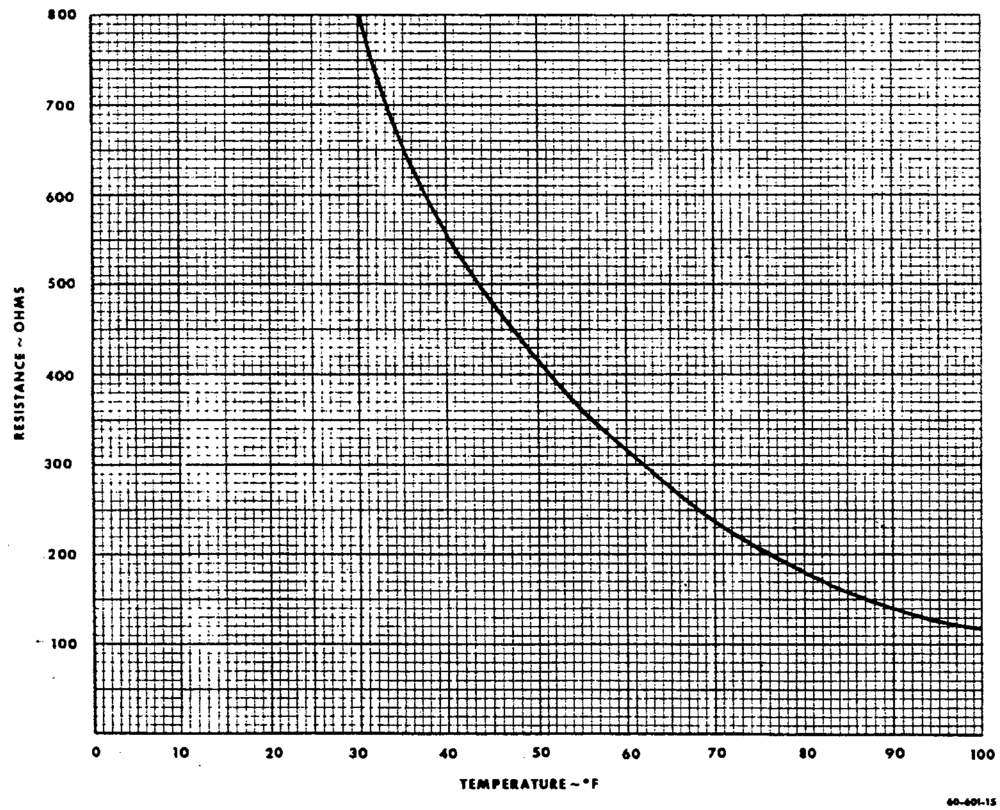
WARNING

Be sure to plug the spark plug hole in the heater to prevent any possibility of residual fuel blowing out and igniting. Do not touch the spark plug while energized because of dangerously high voltage.

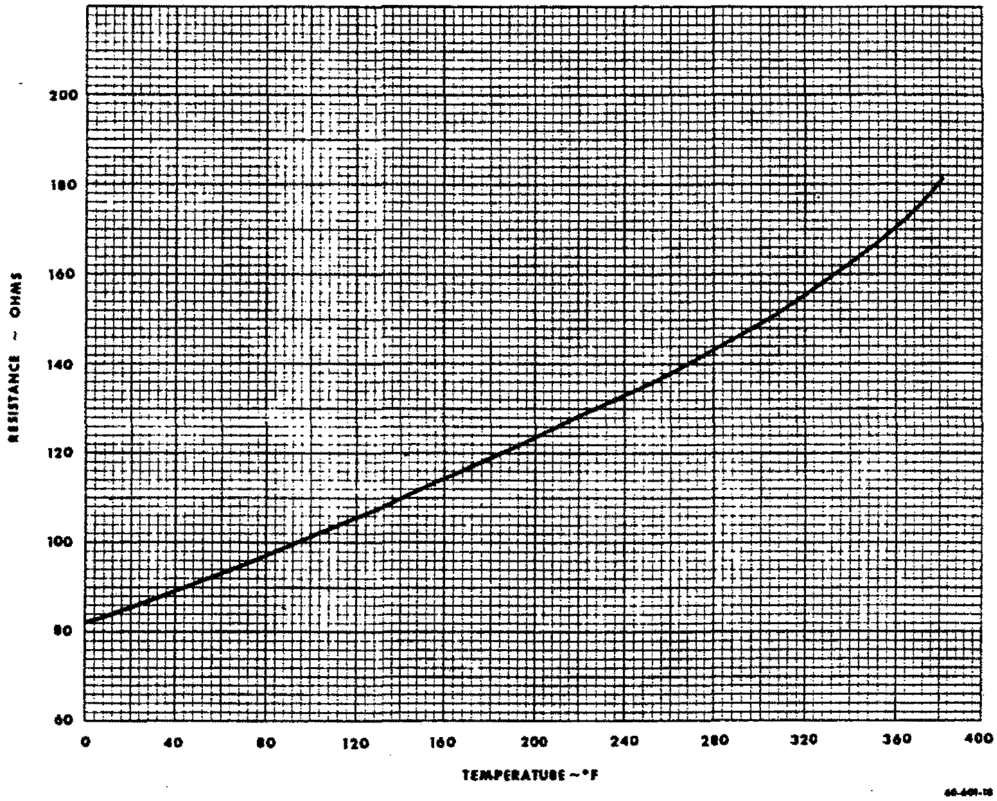
TEMPERATURE SENSORS AND CONTROL RHEOSTAT TEST

NOTE

The aircraft must be in a location, such as a hangar, where temperatures inside and outside of the aircraft are equal and stable. When making the tests, slight variances may occur; however, a defective component will give a definite indication.



Temperature Resistance Curve for Cabin Sensing Element
Figure 203



Temperature Resistance Curve for Heater Discharge Sensing Element
Figure 204

a. Using the graph in Figure 203, determine the correct resistance for the cabin air sensing element. Disconnect wire number H78E18 from terminal "8" of the temperature control box terminal strip. Measure the resistance between the terminal on wire number H78E18 and terminal "6" on the temperature control box terminal strip. Disconnect wire number H75B18 from terminal "5" of the temperature control box terminal strip. Measure the resistance between the terminal on wire number H75B18 and terminal "10" on the temperature control box terminal strip. If the measured resistances do not correspond to the value obtained from the graph, the cabin air sensing element is defective.

NOTE

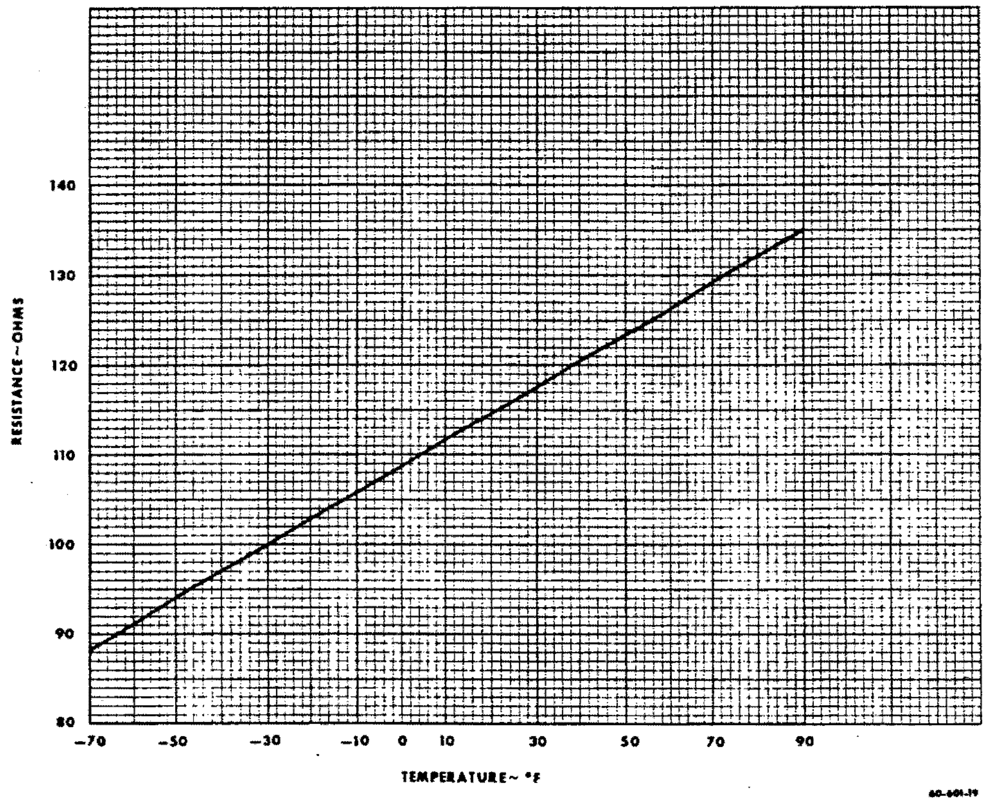
Do not reinstall the disconnected wires on the terminal strip until all tests are complete.

b. Using the graphs in Figures 204 and 205, determine the correct resistance for the heater discharge sensing element and the outside air sensing element respectively, then add these resistance values. Remove wire number H73F18 from terminal "8" of the temperature control box terminal strip. Measure the resistance between the terminal on wire number H73F18 and the terminal on wire H75A18 on terminal "5" of the temperature control box terminal strip. This resistance should equal the added resistance of the two sensing elements. If not, measure the resistance of the two sensing elements. If the resistance does not equal the determined amount, it is defective. If the resistance is correct, the heater discharge sensing element is defective.

c. Rotate the cabin temperature control to the full increase position. Using the graph in Figure 204, determine the resistance for heater discharge sensing element.

d. Disconnect wire number H77B18 from terminal "2" of the temperature control box terminal strip. Measure the resistance between the terminal on wire H77B18 and terminal "1" of the temperature control box terminal strip. If the resistance does not equal the determined value, the heater discharge sensing element is defective.

e. With the test probes still attached as noted in step "d", rotate the cabin temperature control to the full decrease position.



Temperature Resistance Curve for Outside Air Sensing Element
Figure 205

The resistance on the ohmeter should increase 250 ohms. If the resistance increase is higher or lower, the cabin temperature control rheostat is defective.

f. Reinstall all disconnected wires to their respective terminals.

FUEL PUMP

An electric fuel pump, located in the LH wing stub, provides fuel to the heater at a pressure of 7 psi. A solenoid operated fuel regulator regulates fuel pressure and acts as a remote shutoff for the heater, regardless of fuel inlet pressure variations.

"END"

COOLING - DESCRIPTION AND OPERATION

The optional air conditioning system is a recirculating air cooling system containing a 16,000 BTU refrigerative type cooler. The unit is controlled by an automatic temperature control and three sensing elements.

A six position mode switch controls the heater and air conditioner systems: however, each system operates independently of the other. When placed in AUTO position, the temperature is automatically controlled through the temperature controller located on the forward pressure bulkhead above the pilot pedals. It also regulates the cabin temperature variations monitored at the sensing units. The sensing units are located in the ram air inlet, heater outlet duct and forward of the two pressure control valves on the rear pressure bulkhead. When placed in the MANUAL COOL HI position, the switch bypasses the automatic controls and allows maximum air conditioning output. The maximum output is limited by an evaporator thermal switch and an overpressure switch. The MANUAL COOL LO position allows a hot-gas bypass valve (if installed) to be cycled on and off by a timer. The bypass valve regulates the flow of refrigerant to the condenser allowing partial cooling of the cabin.

On serials P-123, P-127 and after, a MANUAL COOL position replaced the MANUAL COOL HI and LO positions on the mode selector switch. Two BLOWER positions are placed on the mode switch to allow the blower to be selected without cycling through the opposite mode.

The air scoop and ramp assembly located in the upper RH nacelle controls the air circulation through the condenser compartment and is completely automatic. The air scoop and ramp assembly has three positions, "closed" (when the air conditioning is not in use), "flight" (air scoop extended about 2 inches above the nacelle), and "ground" (air scoop fully extended). When the air conditioning is turned on, a switch incorporated on the landing gear selects air scoop position; gear down, the air scoop will open to the "ground" position; gear off the ground, the air scoop will open or lower to the "flight" position. The condenser fan, which is wired in circuit with the landing gear safety switch, operates only when the air conditioning mode is selected and the airplane is on the ground.

REFRIGERATIVE AIR COOLING SYSTEM

The air conditioning system is similar to many home and automotive units and consists of six major components. The belt-driven compressor, which is coupled by a magnetic clutch, compresses the refrigerant to a high pressure, high temperature gas. This gas passes through the condenser where cooling air removes heat from the gas, condensing it to a liquid state. The liquid is then stored in the receiver-dryer where any moisture or foreign material is removed from the system. The refrigerant flows to the expansion valve where it is metered into the evaporator at a rate which allows all the liquid to return to a gas. The heat required for evaporation is absorbed from the cabin air passing over the evaporator coils. After passing through the evaporator, the refrigerant returns to the compressor at a reduced pressure. For partial cooling, a hot gas bypass valve allows a portion of the gas to bleed off from the condenser, cycling back through the compressor.

NOTE

Beginning with airplane serials P-123, P-127 and after, and prior airplane's having installed Kit Number 60-5006, the hot gas bypass valve, line and suction accumulator were removed from the system.

An overpressure switch and a pressure relief valve are incorporated into the system to regulate system (compressor discharge) pressure. The overpressure switch is located in the condenser compartment of the right nacelle and is set to actuate at 375 ± 10 psi. When this switch is actuated, power is removed from the compressor magnetic clutch and the 3 amp fuse is shorted through a resistor to ground. A pressure relief valve, located on the compressor discharge line immediately before it enters the condenser, is set to bleed off pressure at 450 psi.

On airplane serials, P-275 and after, and on those prior airplanes which have complied with Service Instructions 0599-427, a low pressure switch is installed on the evaporator. This switch is designed to actuate when the refrigerant pressure drops to 7 ± 1 psi. The actuation of the low pressure switch shorts the 3 ampere fuse to the airplane structure through the resistor located near the evaporator. The fuse, located in the right nacelle, is thus opened, preventing further operation of the compressor magnetic clutch and the compressor until the air conditioner system has been serviced.

NOTE

The low pressure switch which was originally installed on airplane serials P-275 through P-292 and P-294, prior to compliance with Service Instructions 0599-427, actuated at a pressure of 18 ± 2 psi.

"END"

COOLING - MAINTENANCE PRACTICES

Servicing the air conditioning system consists of periodically checking the refrigerant level, checking compressor oil level and changing the system air filter. Recharge the system whenever the refrigerant level is low, air has entered the system or components carrying refrigerant are replaced. Refrigerant leaks may be detected by inspection with flameless leak detector.

The refrigerant level may be observed through the sight glass located in the RH wheel well (P-4 through P-144) or by removing a plug button from the forward section floorboard forward of the copilot's seat (P-145 and after).

CHARGING THE AIR CONDITIONING SYSTEM

When working on a refrigerative air cooling system, observe the following special servicing precautions:

a. Remember, this is a high pressure system. When disconnecting a line, loosen the fittings just enough to bleed off pressure slowly, then disconnect the fitting.

b. Whenever a line is disconnected, purge the entire system with a vacuum pump operating at the 125 micron level.

c. Use only refrigerant (17, Chart 207, 91-00-00); other refrigerants, particularly those containing methyl chloride, will cause rapid deterioration of the aluminum compressor components.

d. When servicing the system with refrigerant, avoid smoking or working near an open flame. Refrigerant passing over an open flame will produce a highly toxic phosgene gas.

Hook the service unit to the connections on the compressor. The abbreviation DISCH or the letter "D" on the compressor cylinder head designates the discharge service valve. The word SUCTION or the letter "S" on the compressor cylinder designates the suction service valve.

When charging a completely purged system, charge with 5 pounds of refrigerant. After charging, the sight glass should be observed for bubbles or a milky appearance caused by an insufficient refrigerant level.

If it is necessary to add refrigerant to a partially charged system, add refrigerant slowly until a satisfactory condition is observed through the sight glass, then add an additional 1/4 to 1/2 pound of refrigerant.

NOTE

After the system has been charged the compressor oil level should be checked as outlined under CHECKING COMPRESSOR OIL LEVEL.

AIR CONDITIONING FUNCTIONAL TEST

With the compressor running at 1,100 rpm a functional check may be made in accordance with Chart 201. Charge the system as outlined in CHARGING THE AIR CONDITIONING SYSTEM.

CHECKING COMPRESSOR OIL LEVEL

(Figure 201)

The compressor oil level should be checked by a qualified air conditioner man at the following times:

a. After the air conditioner has operated for the first time.

b. At the beginning of each season's operation.

c. When oil is emitted from the compressor during servicing operation.

d. After the air conditioning system has been recharged.

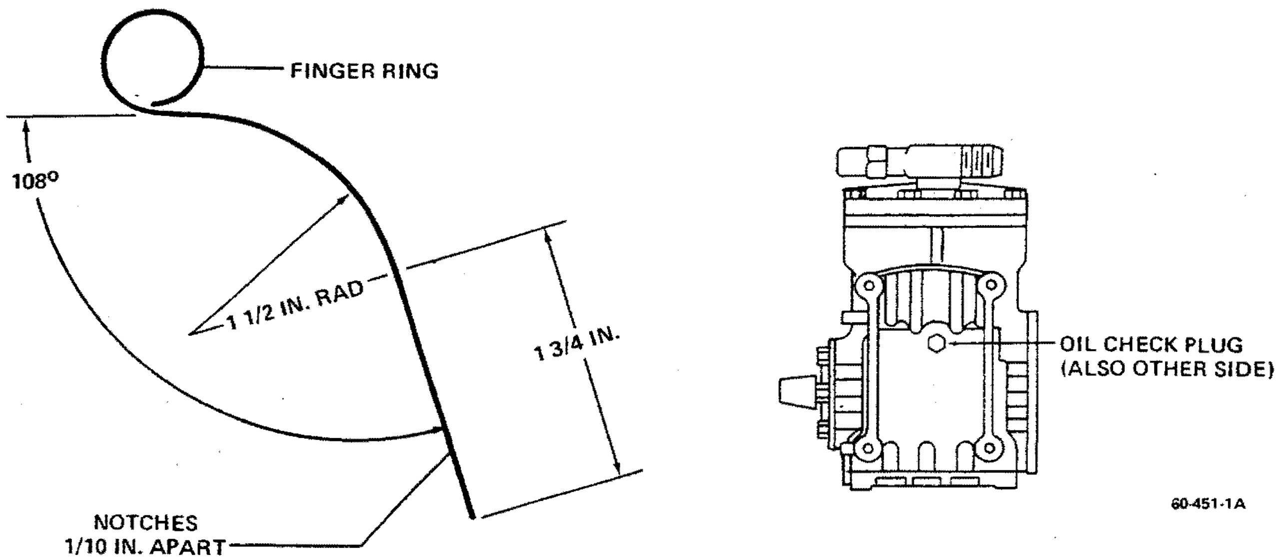
e. If a component is replaced.

The compressor is serviced with oil (18, Chart 207, 91-00-00). Only these or equivalent oils should be used when adding oil. To check the compressor oil level, use the following procedure:

CHART 201
AIR CONDITIONING FUNCTIONAL TEST

TEMPERATURE °F		COMPRESSOR PRESSURE (PSI)	
AMBIENT (OAT)	PLENUM (MAX)*	SUCTION	DISCHARGE
60	45	15 - 20	120 - 170
70	49	15 - 22	140 - 200
80	54	15 - 25	165 - 230
90	59	18 - 30	185 - 260
100	64	20 - 35	205 - 290
110	69	22 - 40	230 - 320

*Measure temperature at outlet nearest plenum



Dipstick and Compressor Oil Check Plug
Figure 201

a. Operate the air conditioner for approximately 15 minutes in which the last 5 minutes should be at low engine rpm (1,000 to 1,100). This allows the oil to accumulate in the compressor for an accurate oil level reading.

b. Attach service gages to compressor service valve ports.

c. With air conditioner operating, slowly close the suction service valve until the suction pressure gage reads 0 or slightly below.

d. Stop the air conditioner and quickly close the suction service valve when the suction gage reads a little above zero.

e. Close the discharge service valve.

f. With both service valves closed, the suction pressure will slowly rise to about five pounds gage pressure.

g. The remaining pressure is relieved by unscrewing the plug for 5 full turns and bled to zero pressure.

h. Remove the oil plug and O-ring.

i. To place the crank throw in the best position for dip stick insertion, point the keyway on the compressor shaft up toward the cylinder head.

j. Insert an oil dipstick until the end contacts the bottom of the crankcase. Remove and measure the oil depth.

NOTE

A compressor oil level depth of 1.5 to 1.8 inches is satisfactory. If the oil level is below 1.5 inches, add oil (18, Chart 207, 91-00-00), then remeasure.

CHART 202
CHECKING COMPRESSOR OIL LEVEL

Dip Stick Depth (In.)	Oil to be Added (Oz.)
.6	8.0
.8	6.5
1.0	5.0
1.2	3.0
1.4	1.5

Oil should be removed when depths greater than 1.8 inch are observed.

Compressor oil level reduces .4 to .7 inches during operation at maximum rpm and also drops slightly with reduced evaporator loads. Approximately 7 oz. of oil is required to initially wet the system and circulate with the refrigerant. When an evaporator or condenser coil is changed, add approximately 2 oz. of oil on installation, then check and adjust the oil level as recommended. A locally manufactured dip stick (see Figure 201) may be fabricated from 1/8 inch diameter rod; a nonferrous material, which is not subject to corrosion, is preferred. Notches cut 1/10 inch apart will aid in visually detecting oil depth.

k. Install the oil plug and O-ring and check for leaks using a flameless leak detector.

l. Unseat both the suction service valve and the discharge service valve and turn to the full aft position.

m. Remove the service gages and install the caps on the service ports.

n. The aircraft may now be returned to service.

EVAPORATOR AIR FILTER REPLACEMENT

The evaporator air filter should normally be replaced annually. Actual replacement may be required more often due to extremely dusty operating conditions.

a. Remove the necessary equipment in the nose compartment to gain access to the floorboards forward of the pressure bulkhead.

b. Remove the screws securing the top of the evaporator filter access plate.

c. Cut the cord securing the filter to the evaporator plumbing.

d. Remove the old filter.

e. When installing the new filter, be sure the reinforced backing of the filter is placed against the evaporator coil.

RIGGING THE AIR SCOOP

(Figure 202)

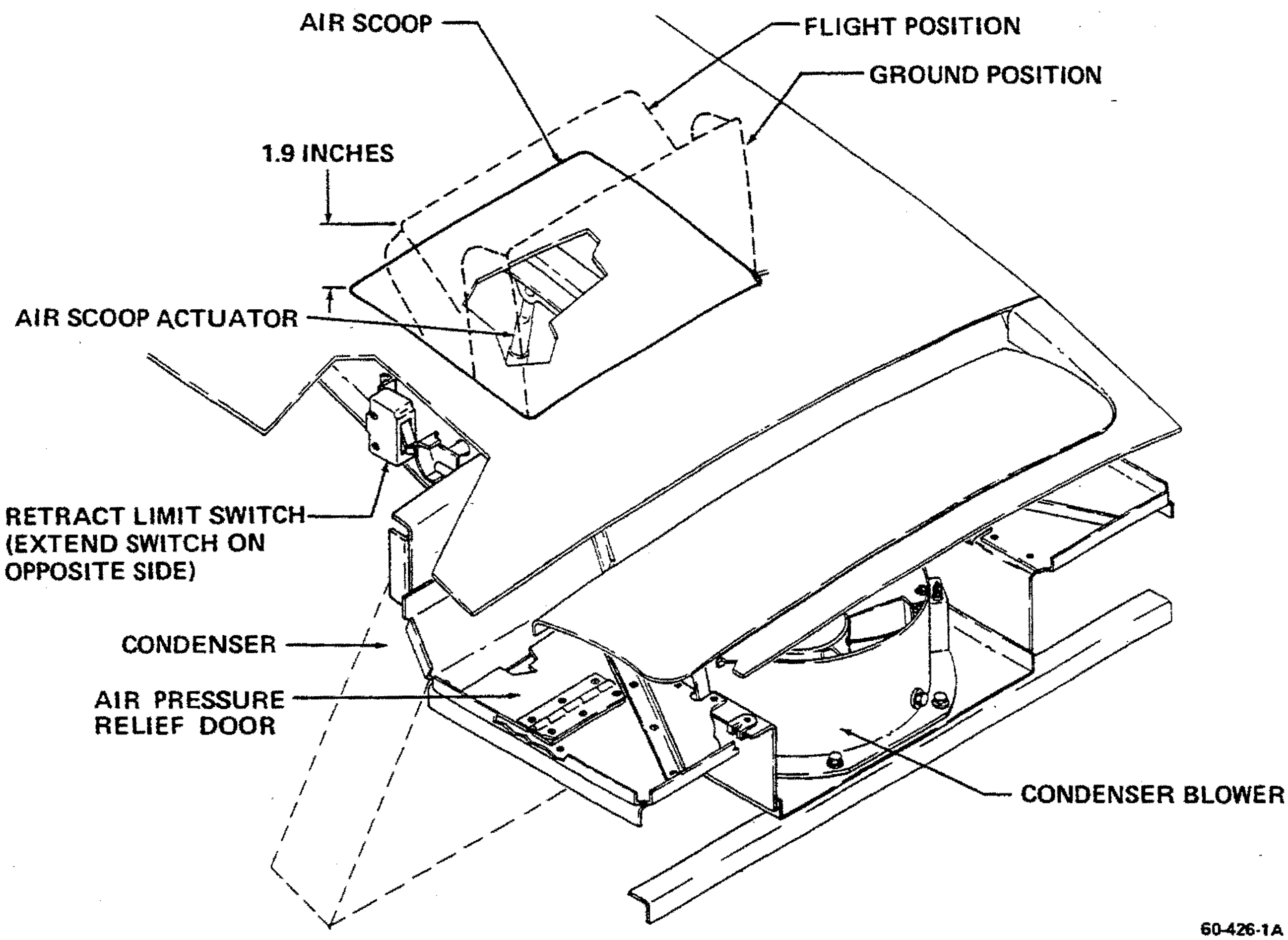
Two limit switches control the air scoop actuator travel for the flight and ground positions. The extend limit switch limits the air scoop travel from the closed position to the flight position. The retract switch limits the air scoop travel from the ground position to the flight position. The air scoop and limit switches may be adjusted as follows:

a. Disconnect the air scoop actuator rod end by removing the attaching bolt and nut.

b. With power on, run the actuator in to its internal limit and loosen the rod end check nut.

c. With the air scoop faired to the nacelle adjust the rod end to the attaching bolt but do not secure the actuator to the air scoop at this time. Tighten the rod end check nut.

d. Manually raise the air scoop 1.9 inches above the top of the nacelle and hold this position while adjusting the switches.



Air Scoop
Figure 202

e. Loosen the attaching screws and move the switches in their slotted mounts until they actuate (a distinct click is audible) in the following order: the extend switch actuates first when the air scoop moves up from the closed position; the retract switch actuates first when the air scoop moves down from the ground position. Secure with the attaching screws.

f. Because the ground position is automatically achieved by the internal limits of the actuator no adjustment is needed.

g. Install the actuator rod end to the attaching bolt and secure the nut.

h. Check for proper operation.

CONDENSER BLOWER REMOVAL

The condenser compartment is located aft of the right nacelle firewall.

a. Remove the screws securing the skin covering the condenser compartment. Position the air scoop and ramp vertically to remove the skin.

b. Remove the pins at the air ramp hinge points and lift the air ramp out.

c. Disconnect the electrical wiring at the terminals on the condenser blower. Remove the screws securing the blower to its mounting bracket and then lift out the blower.

d. Remove the screws securing the blower mount bracket and the two baffles to the condenser compartment. Lift out the mounting bracket and baffles.

e. Disconnect the fittings on the condenser and cap.

WARNING

The lines connected to the condenser are under high pressure. Refer to CHARGING THE AIR CONDITIONING SYSTEM, in this chapter before disconnecting any fitting in the refrigerant system.

f. Remove the screws securing the condenser to its mounting flange and lift the condenser out of the compartment.

CONDENSER BLOWER INSTALLATION

a. Position condenser in condenser compartment and secure with attaching screws.

b. Remove cap and install the fittings to the condenser.

c. Position the two baffles to the condenser compartment and the blower mount bracket and secure with attaching screws.

d. Position the blower to its mounting bracket and secure with attaching screws. Attach the electrical wiring at the terminals on the blower.

e. Position the air ramp to align the air ramp hinges and install the hinge pins.

f. Position the air scoop and ramp vertically to install the skin covering the condenser compartment.

g. Secure the skin with attaching screws.

COMPRESSOR BELT TENSION ADJUSTMENT

After 36 to 48 hours operating time, a new belt will stretch to its normal operating length. The belt tension should be checked at this time and adjusted (by moving the compressor up and down in its slotted mounts) so that a belt tension gage, placed at a point midway between the longest span will register a tension of 100 to 105 pounds. After adjusting the tension on a new belt, be sure the belt has ample clearance on all sides.

COMPRESSOR BELT REMOVAL

a. Remove the RH engine cowling to gain access to the compressor belt.

b. Loosen compressor attaching nuts and slide the compressor upward in its slotted mount to relieve tension on the belt. Roll the belt off the compressor pulley.

c. Remove the bolts attaching the compressor/turbocharger mount support to the engine.

d. Remove the belt from the engine crankshaft pulley and slip it out between the compressor/turbocharger mount and the engine.

COMPRESSOR BELT INSTALLATION

a. Slip the compressor belt between the compressor/turbocharger mount and the engine and position the belt on the crankshaft pulley.

b. Secure the compressor/turbocharger mount support to the engine with attaching screws.

c. Roll the belt onto the compressor pulley. Slide the compressor downward in its slotted mount to apply tension on the belt and secure the compressor attaching nuts.

d. Install the RH engine cowling.

COMPRESSOR REMOVAL

a. Remove the RH engine cowling to gain access to the air conditioner compressor.

b. Disconnect electrical leads to the magnetic clutch.

c. Disconnect refrigerant lines at compressor service valves.

WARNING

The lines connected to the compressor are under high pressure. Refer to CHARGING THE AIR CONDITIONING SYSTEM, in this chapter before disconnecting any fitting in the refrigerant system.

d. Loosen the compressor mounting nuts.

e. Slide the compressor up in its slotted mounting to relieve tension on the drive belt. Roll belt off the compressor pulley.

f. Remove mounting nuts and washers and remove compressor.

COMPRESSOR INSTALLATION

a. Position the compressor in its slotted mounting brackets. Position washers on the compressor studs and loosely install the attaching nuts.

b. Roll the compressor drive belt onto the compressor pulley. For adjustment of the belt refer to COMPRESSOR BELT TENSION ADJUSTMENT.

c. Torque the compressor mounting nuts to 160-190 inch-pounds.

d. Install the refrigerant lines to the compressor service valves.

e. Install the electrical leads to the magnetic clutch.

f. Install the RH engine cowling.

"END"

CHAPTER 22

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
22-EFFECTIVITY/CONTENTS	1	Oct 27/75
22-10-00	1	Oct 27/75
	201	Oct 27/75
22-11-00	1	Oct 27/75
	2	Oct 27/75
	101	Oct 27/75
	102	Oct 27/75
	103	Oct 27/75
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	105	Oct 27/75
	106	Oct 27/75
	201	Oct 27/75

CHAPTER 22 - AUTO FLIGHT

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"END"

GENERAL - DESCRIPTION AND OPERATION

H-14 AUTOPILOT

The primary components of the autopilot pneumatic system are shown in Figures 202 and 204 in Chapter 36-00-00. Air pressure picked up from the pressure manifold is admitted to the autopilot pneumatic system through the autopilot control valves.

Servo actuators, powered by air pressure move the aircraft control surfaces. The autopilot may be turned on anytime after the aircraft engines have been started. Because the equipment is transistorized, no warm-up time is required; however, make certain that the gyros are erect and stable prior to engaging the system. Electrical power to the autopilot is interrupted by pulling the autopilot circuit breaker.

"END"

GENERAL - MAINTENANCE PRACTICES

H-14 AUTOPILOT

For maintenance, repair, troubleshooting and testing refer to the procedures described in the BEECHCRAFT H-14 Autopilot Maintenance Manual (P/N 130333F) and the Maintenance Manual Supplement (P/N 98-30603).

Access for adjustment of the autopilot is through a removable panel on the left underside of the fuselage immediately aft of the rear pressure bulkhead.

Adjustment of the pneumatic pressure system is performed by adjusting the various regulators in a specified sequence. A PRESSURIZATION SYSTEM ADJUSTMENT CHART corresponding to applicable illustrations and a general adjustment procedure for each individual regulator are provided in Chapter 36-00-00.

"END"

TROUBLESHOOTING
NEW-MATIC AUTOPILOT

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
ROLL AXIS		
1. Insufficient or excessive pressure indicated on aircraft system gage.	a. Leak in aircraft pressure system.	a. Check all lines and fittings for breaks, looseness, kinks, etc.
	b. Regulator valve improperly adjusted.	b. Adjust regulator valve as outlined in Chapter 36.
	c. Regulator improperly adjusted.	c. Adjust regulator as outlined in Chapter 36.
	d. Faulty (pressure) pump.	d. Replace pump.
	e. Ambient air filter clogged.	e. Clean or replace filter.
	f. Clogged system filter.	f. Check filters as outlined in Chapter 36 and replace if necessary.
2. Aircraft hunts or recovers slowly from turn in one direction.	a. Regulator valve improperly adjusted.	a. Adjust regulator valve as in Chapter 36.
	b. Loose aircraft primary cables or excessive friction in aileron and/or rudder cables, pulleys, bell cranks or loose servo cables.	b. Check security of attachment, binding, etc. and adjust as outlined in Chapter 27.
	c. Leak in servo or servo lines.	c. Check for leaks.
	d. Obstruction in servo lines.	d. Check for foreign matter.
	e. Faulty turn coordinator gyro.	e. Replace turn coordinator.
3. Autopilot sluggish.	a. Low system pressure setting.	a. Check system filters and adjust as outlined in Chapter 36.
4. Aircraft turns continuously on basic stabilization. (Controller "OFF").	a. Aircraft out of trim or improperly rigged.	a. Trim aircraft or check controls for proper rig as outlined in Chapter 27.
	b. Loose primary cables or excessive friction in cables and system. Loose servo cable.	b. Check security of attachment, binding, etc. and adjust as outlined in Chapter 27.
	c. Defective turn coordinator gyro.	c. Replace turn coordinator gyro.
	d. Leak in servo or servo line.	d. Check for servo or line leaks.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
ROLL AXIS (Cont'd)		
5. Aircraft rate of turn too fast or too slow.	a. Improper regulator adjustment.	a. Adjust regulator as outlined in Chapter 36.
	b. Turn coordinator faulty.	b. Replace turn coordinator.
6. Continuous control wheel oscillation in smooth air.	a. Turn coordinator faulty.	a. Replace turn coordinator.
	b. Improper gyro speed or excessive pressure in system.	b. Adjust system pressure as outlined in Chapter 36.
7. No turns or turns in one direction only, in response to turn control or on all modes of navigation coupler operation.	a. Faulty turn coordinator.	a. Replace turn coordinator.
	b. Faulty controller/amplifier.	b. Replace controller/amplifier.
8. Aircraft rolls in one direction only either left or right.	a. Servos improperly phased.	a. See System Block Diagram, Figure 2.
	b. Turn coordinator not plumbed properly.	b. Plumb per System Block Diagram, Figure 2.
9. Aircraft turns in the wrong direction in "CAP" and "TRK" modes.	a. Nav input signal reversed.	a. Reverse connectors to VOR.
10. No aircraft response from navigation coupler in any mode, ground check shows electrical.	a. Faulty turn coordinator gyro.	a. Replace turn coordinator.
	b. Obstruction in pressure lines.	b. Check for foreign matter.
11. Aircraft fails to turn to and hold magnetic headings.	a. Faulty magnetic heading sensor.	a. Replace magnetic heading sensor.
	b. Faulty heading selector resolver.	b. Replace controller/amplifier.
	c. Faulty controller/amplifier.	c. Replace controller/amplifier.
12. Magnetic heading consistently high or low.	a. Heading sensor misaligned in aircraft.	a. Check for proper installation.
	b. Heading azimuth dial shifted on shaft.	b. Tighten screw and recalibrate.
	c. Improper adjustment of controller/amplifier.	c. Calibrate for the magnetic cardinal points.
13. Cardinal headings inaccurate.	a. Controller/amplifier improperly adjusted.	a. Calibrate for the magnetic cardinal points.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
ROLL AXIS (Cont'd)		
13. Cardinal headings inaccurate. (Cont'd)	b. Leak in servo system.	b. Check for leaks.
	c. Low primary pressure.	c. Adjust system as outlined in Chapter 36.
14. Cardinal headings accurate but intermediate headings inaccurate.	a. Faulty heading sensor.	a. Replace the heading sensor.
	b. Faulty controller/amplifier.	b. Replace controller/amplifier.
15. Insufficient or no control in "CAP" and "TRK" modes.	a. Faulty controller/amplifier.	a. Replace controller/amplifier.
	b. Faulty omni converter.	b. Replace omni converter.
	c. Insufficient signal from omni.	c. Repair or replace omni indicator.
	d. "NAV SENS" improperly adjusted.	d. Readjust.
16. Localizer approach is either sluggish or too sensitive.	a. "LOC GAIN" is set high or low.	a. Adjust.
17. No electrical output left or right on controller/amplifier test jacks.	a. No A+ input or improperly grounded.	a. Check A+ and ground.
	b. Defective controller/amplifier or power supply.	b. Replace controller/amplifier or power supply.
18. Output only one way on controller/amplifier test jacks.	a. Defective controller/amplifier.	a. Replace controller/amplifier.
19. No output on HDG mode on controller/amplifier test jacks.	a. Defective controller/amplifier, or harness, or heading sensor.	a. Replace controller/amplifier; or harness, or heading sensor.
20. Heading output on two reciprocal headings, but not on the other two.	a. Defective sensor; or harness; or faulty controller/amplifier.	a. Replace heading sensor, or check harness. Replace controller/amplifier.
21. "O" output when in CAP, TRK, or APP mode, with nav signal.	a. Defective nav switching console; or no nav information; or defective controller/amplifier.	a. Check nav input leads. Replace controller/amplifier.
22. Output voltage in CAP mode decays to "O" voltage.	a. Wrong nav input signals.	a. Check wiring.
	b. Defective switching console (if installed).	b. Repair or replace console.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

TROUBLE		PROBABLE CAUSE		REMARKS
ROLL AXIS (Cont'd)				
22. Output voltage in CAP mode decays to "0" voltage. (Cont'd)	c.	Dirty input signal (AC volts).	c.	Check indicators.
23. Voltage output in MAN, CAP, TRK, and APP mode but none in HDG mode.	a.	Polarization pins reversed on heading sensor plug.	a.	Reverse pins. See System Block Diagram, Figure 2.
24. Nav indicator needle deflects left or right when controller/amplifier or radio is turned on.	a.	One of the components is shorted to ground.	a.	Check for shorts.
25. Low or high intercept angle.	a.	Incorrect setting on controller/amplifier.	a.	Adjust intercept angle.
	b.	Low or high voltage output on nav indicators.	b.	Check nav indicators to manufacturer's specs.
PITCH AXIS				
1. Pitch channel will not center up electrically.	a.	Defective pitch/altitude sensor or amplifier.	a.	Check on Test Set TS-108 or replace one at a time.
2. Altitude channel will not center up electrically.	a.	Defective pitch/altitude sensor or amplifier.	a.	Check on Test Set TS-108 or replace one at a time.
3. Altitude hold solenoid valve will not actuate.	a.	Pressure switch on servo control valve out of circuit.	a.	Check for faulty switch and replace if necessary.
	b.	Defective solenoid valve.	b.	Replace solenoid valve.
	c.	Defective altitude switch on controller/amplifier.	c.	Check continuity. See System Block Diagram, Figure 2.
4. Servo control valve will not center.	a.	Improper pressure adjustment.	a.	Adjust pressure as outlined in Chapter 36.
	b.	Sticky valve.	b.	Replace valve.
5. Output voltage is inadequate.	a.	Pitch/altitude amplifier sensor or harness shorted or improperly wired.	a.	See System Block Diagram, Figure 2, run check for shorts.
6. Pressure switch will not make contact when pressure is on.	a.	Defective pressure switch or not set at proper pressure.	a.	Replace pressure switch.
7. Output voltage one way only on pitch and altitude channels.	a.	Servo control valve shorted to ground.	a.	Replace valve.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

TROUBLE		*PROBABLE CAUSE*		*REMARKS*
PITCH AXIS (Cont'd)				
8. System will not maintain trimmed configuration even though centered electrically.	a.	Servo control valve not pneumatically centered.	a.	Disconnect electrical power. Center valve pneumatically by use of differential gage to ± .04 in Hg.
	b.	Leak in servos or improperly rigged.	b.	Check for leaks and rig.
	c.	Leak in pitch/altitude sensor.	c.	Replace sensor.
9. System will not respond to airspeed changes.	a.	Primary vacuum (pressure) not set properly.	a.	Adjust pressure as outlined in Chapter 36.
	b.	Pitot pressure inadequate.	b.	Check pitot plumbing.
	c.	Decay rate improperly adjusted.	c.	Adjust as required.
10. System will not respond to up command adjustment.	a.	Defective pitch/altitude amplifier.	a.	Replace pitch/altitude amplifier.
	b.	No EVT potentiometer.	b.	Replace turn coordinator.
11. System will not respond to altitude gain adjustment.	a.	Pitch/altitude amplifier limiter improperly set.	a.	Adjust as required.
12. Aircraft has long term oscillation about pitch axis with altitude hold OFF.	a.	Decay rate improperly adjusted.	a.	Adjust as required.
	b.	Pitch altitude gain improperly adjusted.	b.	Adjust as required.
	c.	Friction in elevator or servo system.	c.	Check for friction and correct.
13. Aircraft has short term oscillation about pitch axis.	a.	Decay rate too tight.	a.	Adjust as required.
	b.	Pitch gain too high.	b.	Adjust as required.
	c.	Primary pressure too high.	c.	Readjust pressure as outlined in Chapter 36.
14. Aircraft oscillates with altitude hold ON.	a.	Altitude gain too high.	a.	Adjust as required
	b.	Decay rate improperly adjusted.	b.	Adjust as required.
15. Aircraft does not return to altitude when displaced.	a.	Altitude hold solenoid inoperative.	a.	Replace solenoid.

TROUBLESHOOTING
NEW-MATIC AUTOPILOT (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
PITCH AXIS (Cont'd)		
15. Aircraft does not return to altitude when displaced. (Cont'd)	b. Leak in altitude system.	b. Check for leaks.
	c. Altitude limiter improperly adjusted.	c. Adjust as required.
16. Aircraft descends or ascends continually when system engaged.	a. Servo control valve not phased correctly.	a. Apply positive 6.0 volts (max) to blue lead and verify nose up response.

"END"

GENERAL - MAINTENANCE PRACTICES

NEW-MATIC AUTOPILOT

For maintenance, repair, troubleshooting and testing refer to the procedures described in the BEECHCRAFT New-Matic Autopilot B-8 Ground and Flight Check Procedures Manual (P/N 3957).

"END"

CHAPTER 23

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
23-EFFECTIVITY/CONTENTS	1	Jun 13/84
23-60-00	1	Jun 13/84
	201	Jun 13/84
	202	Jun 13/84

CHAPTER 23 - COMMUNICATIONS

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"END"

STATIC DISCHARGING - DESCRIPTION AND OPERATION

A static electrical charge may build up in the surface of the airplane while it is in flight. This electrical charge, if retained, can cause interference in radio and avionics equipment operation. It is also dangerous to personnel disembarking after landing and to personnel servicing the airplane. Therefore, static wicks are installed on the trailing edges of the flight surfaces and wing tips to aid in the dissipation of the electrical charge. Prior to serial P-581 two static wicks are installed on each wing tip, two on each elevator, and two on the rudder. At serial P-581 and after three static wicks are installed on each wing tip, three on each elevator, and three on the rudder.

"END"

STATIC DISCHARGING - MAINTENANCE PRACTICES

Prior to serial P-581 static wicks, two on each wing tip, two on each elevator, and two on the rudder, are bolted to the flight surfaces. Each of these ten static wicks are removed and installed in the same manner. Starting at serial P-581 and after, there are three static wicks on each wing tip, each elevator, and the rudder. These fifteen static wicks are screwed into their bases which are riveted to the flight surfaces. These bases should not need to be removed in normal service.

STATIC WICK REMOVAL (Prior to P-581)

a. Remove the two screws and lock washers securing the wick to the surface.
b. Remove the wick from the surface.

STATIC WICK INSTALLATION (Prior to P-581)

Clean around the static wick area by:

a. Removing all anodic film, grease, oil, paints, lacquer, metal finishes or other high resistance properties with Minnesota 3M No. 600 grit sandpaper, or equivalent, and solvent (41, Chart 201, 91-00-00). The mating surfaces must be smooth and contoured so that maximum surface area is in actual contact.

NOTE

Acceptable substitutes for the preceding may be used in accordance with MIL-B-5087B or the surface may be prepared in accordance with MIL-M-3171C.

NOTE

Dissimilar materials are not to be used in intimate contact unless suitably protected against electrolytic corrosion. Whenever it is necessary that any combination of such metals be assembled, an interposing material compatible to each should be used.

b. Install the wick, using the two screws and lock washers.
c. Refinish the surface area around the wick attachment point with the original finish or a clear laquer conforming to MIL-L-6806.

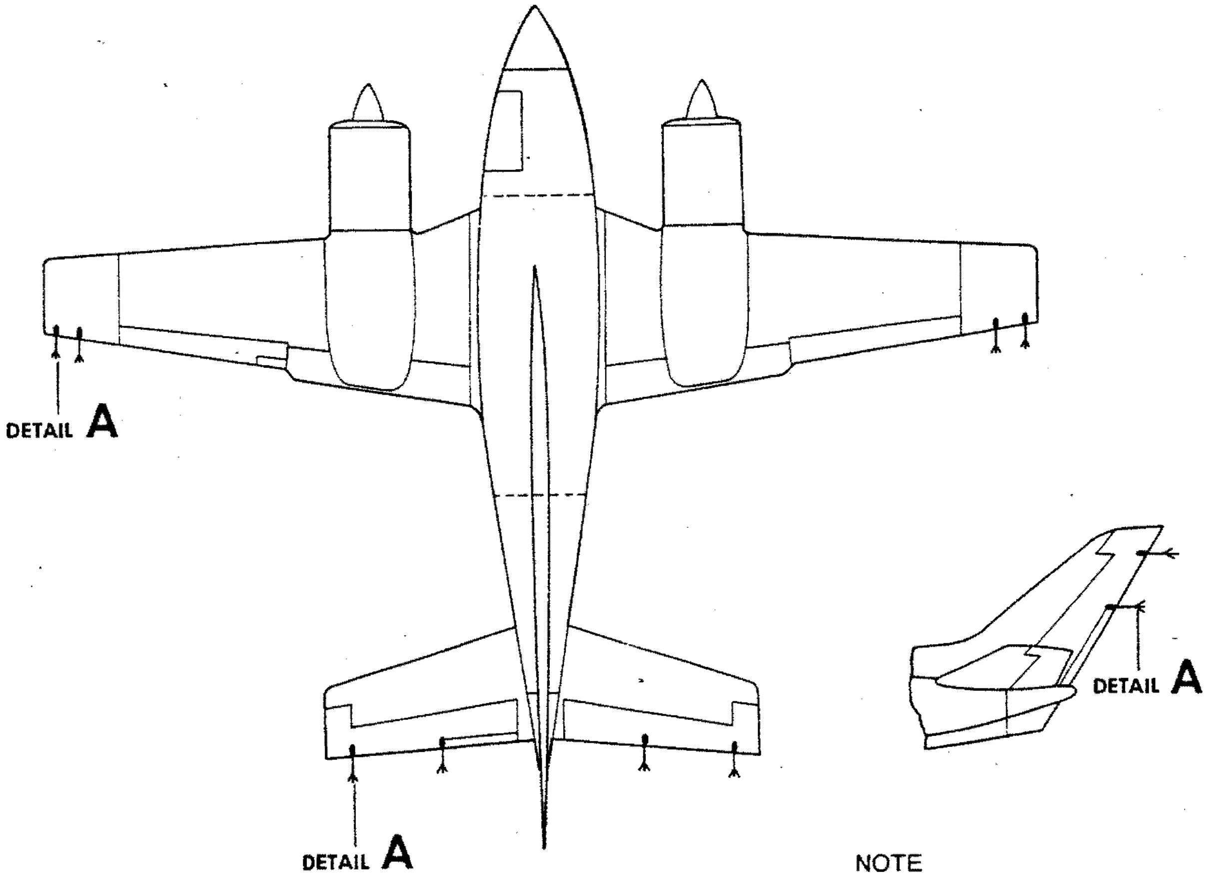
STATIC WICK REMOVAL (P-581 and after)

a. Unscrew the static wick from the base.
b. Remove the static wick and lock washer.

STATIC WICK INSTALLATION (P-581 and after)

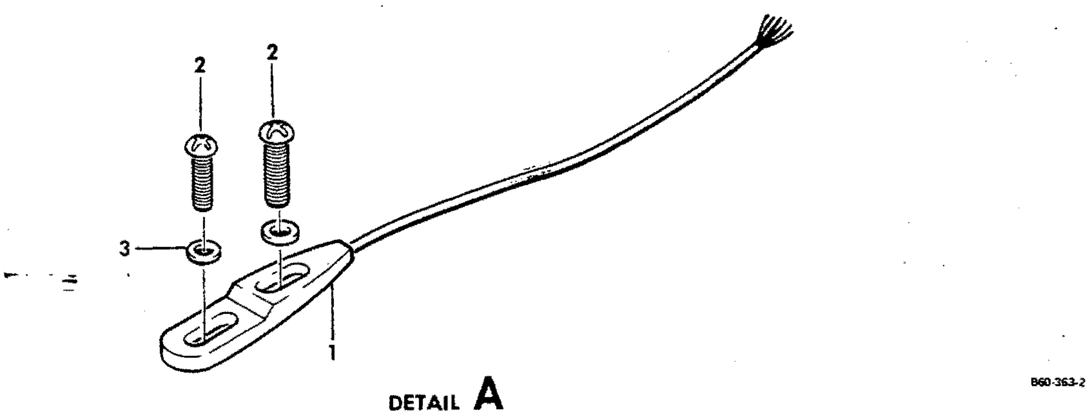
The threads must be clean and free of grease, oil and paint.

a. Install the static wick and lock washer.
b. Torque the static wick to 4.7 inch-pounds.



NOTE

The static wick installation shown is for airplanes prior to P-581 with static wicks installed in groups of two (ten per airplane). On later serials the static wicks are installed in the same general location, in groups of three (fifteen per airplane). Detail "A" is only for the earlier installation.



Static Wicks
Figure 201

"END"

CHAPTER 24

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24-EFFECTIVITY	1	May 12/78
24-CONTENTS	1	May 12/78
	2	May 12/78
24-00-00	1	May 12/78
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	201	May 12/78
	202	May 12/78
	203	May 12/78
	204	May 12/78
24-31-00	101	May 12/78
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	104	May 12/78
	201	May 12/78
	202	Nov 2/73
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	208	May 12/78
	209	May 12/78
24-32-00	201	May 12/78
24-50-00	201	Nov 2/73
	202	May 12/78
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	203	Nov 2/73
	204	Nov 2/73
	205	Nov 2/73
	206	Nov 2/73

"END"

CHAPTER 24 - ELECTRICAL POWER

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CHAPTER 24 - ELECTRICAL POWER

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"END"

GENERAL - DESCRIPTION AND OPERATION

AC GENERATION

Since the major portion of the airplane instrumentation functions on dc power, the ac power requirements are confined to only the fuel flow indicator, windshield heat, and some avionics. The inverter for the fuel flow indicator is a small unit designed to supply power only to this instrument. An inverter is installed for the operation of the left windshield heat and is activated by a switch on the pilot's subpanel marked L. WSHLD - OFF. This inverter is also used as a standby for the avionics inverter.

Avionics power is obtained by two switches mounted on the upper switch panel. One is marked MASTER - OFF and activates power to the avionics equipment. For that equipment requiring ac current, a three position switch marked MN INV - OFF - STBY INV must be placed in the MN INV position. Should a failure occur in the main inverter, the switch can be placed in the STBY INV position. This opens a relay to direct the current from the windshield heat inverter to the avionics provided the L. WSHLD switch is on. Because the STBY INV switch position is designed only to direct the current flow, no power can be supplied to the avionics with the L. WSHLD switch in the OFF position. Power for the operation of both systems cannot be supplied by this inverter at the same time.

AC VOLTAGE FREQUENCY INDICATOR

On airplanes that are equipped with the AC Voltage Frequency Indicator, the instrument is located in the pilot's instrument panel below and to the left of the standard turn and slip instrument. This instrument informs the flight crew when the ac voltage and frequency are not within the required limits for accurate operation of the ac power to the turn and slip, directional gyro, attitude and gyro horizon. Two terminal posts are located on the back of the instrument. The electrical wire leading from the main bus is connected to the left terminal post and the line supply is connected to the right terminal post.

DC GENERATION

GENERATORS

The Duke 60 Series electrical system includes two 125 ampere generators. The generators are isolated from the airplane bus by reverse current diodes and generator control relays, and are regulated individually by a carbon-pile type regulator. The circuit of each generator contains an overvoltage relay to protect the airplane system from excessive voltage. Paralleling relays are used to connect the equalization circuits of the voltage regulators and to sense generator output to the annunciators in the pilot's compartment.

BATTERY

The Duke 60 Series airplanes, P-4 through P-225, are equipped with either General Electric or Gulton nickel-cadmium batteries. P-226 through P-445 are equipped with General Electric air cooled nickel-cadmium batteries. For maintenance on these type batteries, refer to BATTERY MAINTENANCE PROGRAM (Airplanes prior to P-446), Chapter 24-31-00.

Airplanes P-446 and after are equipped with two 12 volt lead-acid batteries connected in series to provide 24 volts. To obtain optimum service from the twin battery, proper and regular maintenance of the batteries must be performed. For maintenance procedures on the lead-acid batteries, refer to BATTERY MAINTENANCE PROGRAM (P-446 and after), Chapter 24-31-00.

BATTERY CHARGE CURRENT DETECTOR SYSTEM

The battery charge current detector system installed on airplane serials P-243 through P-445 and those prior airplanes which have complied with Service Instructions No. 0587-356, provides an indication of the amount of battery charge current.

The system consists of a shunt in the negative lead of the battery, a current detector assembly located adjacent to the battery and a yellow caution light (BATTERY CHARGE) on the annunciator panel. The detector assembly receives power through a 5 ampere circuit breaker. The system senses the battery current through the shunt. Any time the battery charge current exceeds approximately 3 amperes for a period longer than approximately 6 seconds, the yellow light will be illuminated.

"END"

TROUBLESHOOTING GENERATOR SYSTEM

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Zero or low charge indicated.	a. Engine speed too low.	a. Increase speed.
	b. Loose connections.	b. Check connections throughout system.
	c. Open or shorted field circuit in generator; defective armature.	c. Test resistance of field. Check field circuit connections. Replace generator if defective.
	d. Brushes not contacting commutator.	d. Clean brushes and holders with a clean lint-free, dry cloth. Replace weak springs.
	e. Brushes worn out.	e. Replace brushes if worn to a length of 1/2 inch or less.
	f. Dirty commutator.	f. With generator running, clean commutator with No. 0000 sandpaper. Use filtered air jet to remove grit.
	g. Defective voltage regulator.	g. Replace regulator.
	h. Defective loadmeter.	h. Replace loadmeter.
2. No generator output.	a. Current limiter blown.	a. Check for short circuit; replace.
	b. Open circuit.	b. Check continuity of circuit.
	c. Defective generator control switches, generator control relay, or reverse current diode.	c. Test switches, relay, or diode. Replace if defective.
	d. Generator not turning.	d. Check generator drive belts. Replace if necessary.
3. Low generator output.	a. Generators not paralleled.	a. Readjust minimum-load voltage. Then readjust paralleling rheostats.
4. Loadmeter reads off scale in wrong direction.	a. Generator field magnetized in wrong direction.	a. Flash field. (Do not flash field when generator is running.)
5. Loadmeter does not read.	a. Loose connection or ground in airplane wiring.	a. Check entire system.
	b. Open fuse in loadmeter circuit.	b. Check for short circuit; replace.

"END"

DC GENERATION - MAINTENANCE PRACTICES

GENERATOR REMOVAL

a. Remove the lower engine cowling.
b. Remove the generator wiring.
c. Remove the generator cooling air duct.
d. Remove the bolt from the adjusting bracket and loosen the attaching bolts of the mounting bracket until the generator can be rotated to permit removal of the drive belts from the generator.
e. Remove the attaching bolts and remove the generator from the airplane.

GENERATOR INSTALLATION

a. Secure the generator to the mounting brackets with the attaching bolts. Leave the bolts loose enough to allow the generator to rotate sufficiently to install the drive belts.

NOTE

To equalize belt service life, the belts must be replaced in pairs.

b. Install the bolt and washer in the adjusting bracket.
c. Position the generator in the mounting brackets so that a four pound pressure applied at the center of the belts will result in 1/4 inch deflection. Tighten the attaching bolts to a torque of 160 to 190 inch-pounds.
d. Safety as necessary.
e. Attach the generator cooling air duct.
f. Attach the electrical wiring and tighten securely.

GENERATOR BRUSH REPLACEMENT

During periodic maintenance inspections, the generator brushes should be inspected for cracks, chipped edges, loose or frayed wire. A lateral groove in the edge of the brush is an indication of the minimum wear length (approximately 1/2 inch). The brush should be replaced if it has been worn to the indicator or if it is obvious that the brush will reach the minimum length before the next inspection time.

New brushes must be properly seated on the commutator surface before the generator is subjected to heavy loads to prevent arcing which will cause burning and pitting of the commutator. New brushes should be sanded and run-in to properly seat them on the commutator surface. Refer to the applicable Vendor Publication (Chapter 20-00-00) for replacement and run-in procedures.

OVERVOLTAGE RELAYS

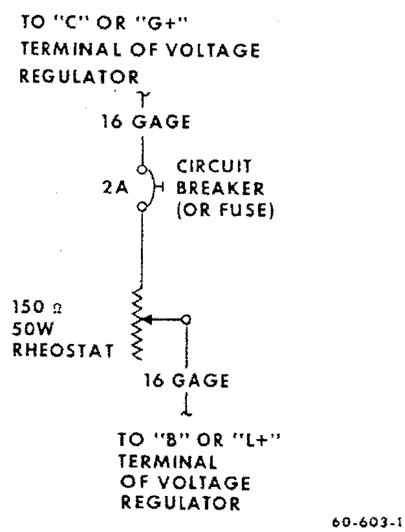
No attempt should be made to adjust the overvoltage relays. They are preset at the factory to trip at a voltage of 33.00 + 0.0 – 0.25 volts. When the relay is determined defective, it should be replaced with a new or exchange relay.

OVERVOLTAGE RELAY CHECK (Figure 201)

The overvoltage relays should be functionally checked for proper operation at 500 hour intervals or whenever an overvoltage relay, voltage regulator or generator is replaced. This test may best be accomplished in the airplane.

A variable resistance introduced in series with the voltage regulator input will allow the generator system to be driven into an overvoltage condition without disturbing the voltage regulator adjustment. The electrical components involved in this check are located in the electrical equipment compartment, immediately aft of the LH nacelle firewall. Test each overvoltage relay separately as outlined in the following procedure:

a. Attach a set of 16 gage test leads to a 2 ampere circuit breaker (or fuse) and a 150 ohm rheostat with a minimum rating of 50 watts.
b. Disconnect the wire, P117A18, from the voltage regulator base terminal which may be marked "B" or "L+". Then, disconnect the wire P116A18 from the terminal marked "C" or "G+".



Overvoltage Test Circuit
Figure 201

NOTE

Refer to the Wiring Diagram Manual, P/N 60-590001-29, for the applicable wiring code.

Attach the test lead from the wiper contact of the 150 ohm rheostat to the "B" or "L+" terminal of the RH voltage regulator.

c. Attach the test lead from the 2 ampere circuit breaker (or fuse) to the "C" or "G+" terminal of the RH voltage regulator. Do not remove the existing wire from the "C" or "G+" terminal.

d. Monitor the overvoltage relay trip voltage with a precision voltmeter that is known to be accurate within one percent over a range of 0 to 50 volts. Connect the voltmeter test leads to the voltage test jacks located on the right circuit breaker panel (P-436 and after). On airplanes prior to P-436, connect the positive lead of the circuit breaker bus behind the subpanel. Connect the negative lead of the voltmeter to the airplane structure.

e. Adjust the 150 ohm rheostat to its minimum resistance setting.

CAUTION

To prevent excessive overvoltage, check the resistance with an ohmmeter to ensure the rheostat is set for minimum resistance prior to initiating this test. Do not operate the system above 29 volts for more than two minutes during the test. If the battery is subjected to voltages in excess of 32 volts for more than two minutes, the battery must be removed from the airplane and completely serviced.

f. Start the engines and advance the throttles as required to obtain desired voltage output.

g. Turn off all switches and circuit breakers except the battery master switch and the generator protection circuit breakers.

CAUTION

Should the test equipment be improperly installed, the airplane electrical equipment may be damaged unless all switches and circuit breakers except those noted above are turned off.

h. After the airplane's loadmeters stabilize at a point below 10 percent of full scale, observe the precision voltmeter while slowly increasing the resistance setting of the 15(ohm rheostat. A sharp drop in voltage will indicate the operation of the voltage relay. This should occur when the precision voltmeter registers a reading of 32 to 34 volts. Th(GENERATOR OUT light on the annunciator panel shoul(illuminate at the same time the overvoltage relay trips. If th(overvoltage relay does not operate within the prescribe(limits, it should be replaced with a new one, then recheckе(for proper operation as in steps "f" through "h".

VOLTAGE REGULATOR ADJUSTMENT ANL GENERATOR PARALLELING

It is desirable that both generators share the electrical loa(equally. To obtain this condition, the voltage regulators an(the paralleling rheostats must be properly adjusted. Th(paralleling rheostats and voltage adjustment potentiometer: are located in the cabin (P-466 and after) for convenient an(precise adjustments. The adjustment procedure is outlined i(the following paragraphs.

PRELIMINARY POTENTIOMETER CHECK

A potentiometer located on each voltage regulator in the le(nacelle, must be permanently adjusted to minimum resis(ance (fully ccw). If the regulators have been changed or th(setting altered for any reason, remove the access cover o(top of the left nacelle, aft of the engine cowling, and ensur(that these potentiometers are adjusted fully counterclock wise. No other adjustments or connections to component located within the nacelle compartment will be necessary f(voltage and paralleling settings.

PRELIMINARY ADUSTMENT OF PARALLELING RHEOSTATS.

a. On airplanes prior to P-466, open the electric(components compartment access cover on top of the le(nacelle aft of the engine cowling. On P-466 and after, remov(the access panel (placarded GENERATOR VOLTAGE AD JUSTMENT) located behind the copilot's seat on the righ side.

b. On airplanes prior to P-466, connect the negativ lead of a voltmeter to terminal "D" on the left voltage re gulator base and the positive lead to the airplane structur((Terminal "D" carries a voltage that is negative with respe(to the airplane structure.) On P-466, connect the negativ lead of a voltmeter to the terminal point of wire P113B18 o the left paralleling rheostat and the positive lead to the term nal point of wire P113C18N on the same rheostat. (Th negative test point carries a voltage that is negative wit respect to the airplane structure.)

c. Operate the LH engine with the generator chargin and carrying a moderate to heavy electrical load.

CAUTION

Monitor the bus voltage as soon as the generators are turned on. Voltages in excess of 32 volts for two minutes will damage the battery.

d. Monitor the voltmeter and turn the LH paralleling rheostat first clockwise then counterclockwise to determine which direction of rheostat rotation results in an increasing negative voltage.

e. Turn the LH paralleling rheostat to a maximum negative voltage then decrease the voltage by turning the rheostat back 1/8 turn.

f. Repeat steps "c", "d", and "e" for the RH system.

STABILIZATION OF GENERATOR SYSTEM

The generators and regulators must be stabilized for temperature changes before any final adjustments are attempted. Operate both engines at approximaely 1,000 rpm with both generators ON and a heavy electrical load turned on. Use the lights, blowers, radio equipment, etc. to obtain a 20% electrical load for each generator. Allow a minimum of 20 minutes to stabilize the system.

CAUTION

Do not operate the heated windshield or pitot heat for extended periods during ground operation. Excessive heat buildup may cause damage to these components.

VOLTAGE ADJUSTMENT (MINIMUM LOAD)

PRIOR TO P-466

On airplanes prior to P-466, the voltage regulators are adjusted to produce a voltage of 28.25 ± 0.25 volts measured at the battery relay with a minimum electrical load on the system as follows:

NOTE

If the airplane is to be operated continuously where temperatures are 32°F or below, the voltage should be adjusted to 28.50 ± 0.25 volts.

a. Connect the positive lead of a portable precision voltmeter to the battery relay. The meter must be capable of measuring 28.25 volts with an accuracy of 1%. Connect the negative lead of the voltmeter to a good ground.

b. Operate both engines at 1 300 to 1 500 rpm with both generators ON, and the electrical load reduced to a minimum.

c. Turn the RH generator OFF. Determine the bus voltage as maintained by the LH generator.

d. Turn RH generator ON and LH generator OFF. Determine the bus voltage as maintained by the RH generator.

e. Turn the LH generator ON, and idle the engines.

NOTE

Maintain temperature stabilization by operating the generators individually for only short periods.

f. Make the necessary voltage adjustments by turning the voltage adjusting potentiometer on the voltage regulator clockwise to increase the voltage and counterclockwise to decrease the voltage. Make the adjustments in small increments only. Allow ample time for the voltage to stabilize before making further adjustment.

g. Repeat steps "b" through "f" until the minimum load voltage is satisfactory.

CAUTION

Never adjust the core or carbon pile adjusting screw (slotted heads in the ends of the regulators). The regulating characteristics of the regulators will be altered as well as the voltage setting.

P-466 AND AFTER

On airplanes P-466 and after, the voltage regulators are adjusted to produce a voltage of 28.25 ± 0.25 volts measured at the main bus with a minimum electrical load on the system as follows:

NOTE

If the airplane is to be operated continuously where temperatures are 32°F or below, the voltage should be adjusted to 28.50 ± 0.25 volts.

a. Connect the positive lead of a portable precision voltmeter to the positive (red) test jack located on the right circuit breaker panel. Connect the negative lead to the negative (black) test jack. The meter must be capable of measuring 28.25 volts with an accuracy of ± 0.25 volts.

b. Operate both engines at 1300 to 1500 rpm with both generators ON, and the electrical load reduced to a minimum. Adjustment of both voltage potentiometers in steps "c" and "d" will provide an increase in voltage when the potentiometers are turned clockwise. Make the adjustment in small increments only. Allow ample time for the voltage to stabilize before making further adjustments.

c. Turn the right generator OFF and adjust the left voltage potentiometer to 28.25 ± 0.25 volts.

d. Turn the right generator ON and the left generator OFF and adjust the right voltage potentiometer to 28.25 ± 0.25 volts.

e. Repeat steps "c" and "d" until the minimum load voltage is satisfactory.

CURRENT ADJUSTMENT (MAXIMUM LOAD)

The paralleling rheostats are adjusted to produce equal outputs from the generators at heavy loads.

a. Check the accuracy of the loadmeters on the instrument panel by alternately switching from one generator to the other while a normal load is turned on. If equal readings are obtained as each generator supplies the current individually, the loadmeters are satisfactory. If excessive deviation in loadmeter readings exist, the loadmeters should be replaced.

b. Operate both engines at 1 300 to 1 500 rpm with both generators ON. Turn on all feasible electrical loads using lights, blowers, radio equipment, etc, except pitot heat and heated windshield.

c. Read the loadmeters. Each generator should take its share of the load within 10% of the loadmeter full scale reading.

d. Adjust the paralleling rheostats until the load is equally shared by increasing the output from the low generator and decreasing the output from the high generator.

NOTE

To maintain sensitivity, keep both rheostats as near the maximum voltage end of the rheostat as possible. There is a possibility of excessive sensitivity resulting in a "hunting" condition. Should such a condition be encountered, sensitivity may be reduced by turning both paralleling rheostats away from the high voltage end.

e. Check both minimum current voltage and ma imum current paralleling at cruise engine rpm (2,750 rpm

FINAL PARALLELING CHECKS

PRIOR TO P-466

a. Secure the access cover in place using sufficie fasteners to hold the cover securely in place during engi operation.

b. Stabilize the regulator and generator temperatur as outlined in STABILIZATION OF GENERATOR SYSTE

c. Check both minimum load voltage and maxim current paralleling at cruise engine rpm (2,750 rpm).

d. Remove the cover and make any necessary a justments. Replace the access cover and repeat the chec

e. After determining that the adjustments are sa factory, secure the access cover in place using all fastene

P-466 AND AFTER

a. Stabilize the regulator and generator temperatu as outlined in STABILIZATION OF GENERATOR SYSTE

b. Check both minimum load voltage and maxim current paralleling at cruise engine rpm (2750 rpm).

c. Make all necessary adjustments before replaci the access panel.

"END"

TROUBLESHOOTING BATTERY SYSTEM

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. No power indicated with battery master switch ON.	a. Battery discharged or defective.	a. Recharge or replace battery.
	b. Open circuit between battery and master switch.	b. Check continuity.
	c. Master switch defective.	c. Check switch for operation.
	d. Defective relay.	d. Check relay operation.
2. Power on with master switch in OFF position.	a. Master switch defective.	a. Check switch for operation.
	b. Relay contacts stuck.	b. Check and replace relay if necessary.

TROUBLESHOOTING NICKEL-CADMIUM BATTERY

1. Apparent loss of capacity.	a. Cells unbalanced.	a. Equalize cell voltage by performing full capacity discharge cycle.
	b. Electrolyte level too low.	b. Charge, adjust electrolyte level, and capacity test.
	c. Charging rate too low in airplane.	c. Check and adjust airplane charging system.
	d. Too little usage or shallow discharges.	d. See "a" above.
2. Complete failure to operate.	a. Loose or broken lead.	a. Repair or replace.
	b. Loose or disengaged terminals in battery.	b. Repair or replace any damaged hardware, and capacity test.
	c. Battery not charged.	c. Charge and capacity test.
	d. Cell open internally.	d. Replace defective cell and capacity test.
3. Excessive spewage (crystalline deposits on outside of cells).	a. Excessive charge rate.	a. Clean the battery, recondition, adjust the electrolyte level and capacity test. Adjust voltage regulator of airplane.
	b. Electrolyte level too high.	b. Clean cell.
	c. Vent caps loose or broken.	c. Clean cell, replace or tighten vent cap.
	d. Cracked cell case.	d. Replace cell, clean battery.

TROUBLESHOOTING
NICKEL - CADMIUM BATTERY (Cont'd)

TROUBLE	PROBABLE CAUSE	REMARKS
4. Cell cases distorted.	a. Excessive charge rate.	a. Clean the battery, recondition, adjust the electrolyte level and capacity test. Adjust voltage regulator of airplane.
	b. Cell with internal short.	b. Replace defective cell, recondition and capacity test.
	c. Plugged vent caps, minor explosion.	c. Disassemble, replace defective parts, clean the battery, recondition and capacity test.
5. Unequal voltages among cells.	a. Cells unbalanced.	a. Equalize cell voltages (perform a full capacity discharge cycle) and capacity test.
6. Foreign matter within cells.	a. Impure or acid-contaminated water.	a. Such cells will not normally respond to charging. They will show up as unbalanced cells and must be replaced.
7. Frequent addition of water.	a. Unbalanced cells.	a. Equalize cell voltages.
	b. Leaky or defective cells, damage to O-ring or vent cap.	b. Replace defective parts and inspect for electrolyte leakage. Clean, recondition and level electrolyte.
8. Burn marks on connectors.	a. Loose connectors.	a. Tighten connectors.
9. Overheating of inter-cell connectors.	a. Loose or dirty inter-cell connectors.	a. Disassembly, clean, reassemble and properly torque inter-cell connectors, and capacity test.
10. Foam or bubbling during charging.	a. Oil or grease contamination in the electrolyte.	a. Replace defective cells.
	b. Low concentration of electrolyte.	b. Recondition, replace cells that continue to foam.
11. Below normal output.	a. Battery switch left ON.	a. Recharge and capacity test.
	b. Voltage regulator set too low.	b. Recharge and capacity test. Reset voltage regulator.
	c. Internal connection links loose.	c. Torque, recharge and capacity test.
	d. External connector burned or pitted.	d. Clean or replace, recharge and capacity test.
	e. Cell case current leakage.	e. Disassemble, clean and recondition, replace any defective cells, and capacity test.

TROUBLESHOOTING
LEAD-ACID BATTERY

TROUBLE	PROBABLE CAUSE	REMARKS
1. Battery will not hold its charge.	a. Battery is worn out.	a. Replace battery.
2. Battery will not come up to full charge.	a. Charging rate set too low.	a. Adjust voltage regulator on airplane.
3. Battery consumes water rapidly.	a. Faulty battery.	a. Replace battery.
	b. Voltage regulator set too high.	b. Adjust voltage regulator on airplane.
4. Electrolyte runs out of vent plugs.	a. Electrolyte level too high.	a. Remove excess electrolyte down to specified level.
	b. Excessive charging rate.	b. Adjust voltage regulator on airplane.
	c. Vent caps loose or broken.	c. Replace or tighten vent caps.
5. Battery low.	a. Standing too long.	a. Remove battery and recharge.
	b. Equipment left on accidentally.	b. Remove battery and recharge.
	c. Short circuit or ground in wiring.	c. Check wiring and correct malfunction, then remove battery and recharge.
	d. Broken cell partition.	d. This is usually indicated by two or more adjacent cells running down continually, particularly, if left standing a few days. Replace battery.
6. Compound on top of battery melts.	a. Charging rate too high.	a. Adjust voltage regulator on airplane.
7. Cell connector melted in center.	a. Shorted or grounded cable causing direct full discharge of battery.	a. Check cables and repair malfunction. Replace battery.
8. Battery freezes.	a. Discharged.	a. Replace battery.
	b. Water added in cold weather without charging the battery sufficiently afterward to thoroughly mix the water with electrolyte before letting stand.	b. Replace battery.
	c. Too low specific gravity of the electrolyte caused by improper filling.	c. Replace battery.

TROUBLESHOOTING
LEAD-ACID BATTERY

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
9. Cracked cell jars.	a. Hold down loose.	a. Replace battery.
	b. Frozen battery.	b. Replace battery.

"END"

DC GENERATION - MAINTENANCE PRACTICES

BATTERY MAINTENANCE PROGRAM (Airplanes prior to P-446)

A Systematic Battery Maintenance Program should be established and carefully followed.

CAUTION

Methods of servicing lead-acid batteries do not apply for the servicing of nickel-cadmium batteries.

a. The battery should be removed from the airplane for service.
b. A log of the services performed on each battery should be maintained.
c. The battery should be removed from the airplane and serviced after: 100 flight hours or 30 days, whichever occurs first. If the ambient temperatures are above 90°F or the time between engine starts averages less than 30 minutes, the duty cycle should be reduced.
d. The log of battery services performed should be evaluated to determine the need to service the battery at the above recommended intervals or to extend the intervals if justified. Accurate water consumption data is a valid barometer to use for adjustment of the servicing intervals.

Since the proper battery servicing requires two days, an additional battery (or batteries) will be required where airplane utilization warrants. For additional information on battery maintenance, refer to Gulton Instructions for Use and Care of Sintered Plate Vented Nickel-Cadmium Storage Batteries (P/N ABD-1100), or Marathon Battery Instruction Manual (P/N BA-89), or Operating and Service Manual for General Electric Nickel-Cadmium Vented-Cell Batteries (P/N GET-3593A), which ever the airplane is equipped with. Advisory Circular AC 00-33, printed by Department of Transporation, Federal Aviation Administration, is another good source of battery maintenance information.

MAINTENANCE LOG

Customers are advised to keep a complete and up-to-date maintenance log on each battery. This information will help determine the source of any battery problems and will assist in substantiating warranty claims. A sample format for a maintenance log is illustrated on the following page.

BATTERY REMOVAL

a. Remove the upper access door to the electrical equipment compartment, aft of LH nacelle firewall.
b. Cut the safety wire and remove the battery quick-disconnect.
c. On serials P-226 through P-445, equipped with General Electric air cooled batteries, disconnect the cooling ducts.
d. Disconnect the battery vent tubing.
e. Cut the safety wire, remove the two nuts from the battery hold-down bar and lift the battery out of the well.

PRE-INSTALLATION INSTRUCTIONS FOR NICKEL-CADMIUM BATTERIES

Unless otherwise indicated by a red warning tag, a nickel-cadmium battery is shipped in fully discharged state and contains the proper amount of electrolyte.

Observe the following precautions to ensure maximum performance and to protect the battery warranty.

a. Do not remove the shorting strap until prepared to charge the battery. Batteries from which the shorting strap has been removed (for even a short period of time) must be considered in an unknown state of charge condition and must be completely discharged prior to charging and installation.
b. Inspect batteries shipped from the factory for shipping plugs in the vent holes of each of the battery cells. The blunt aluminum screws that serve as shipping plugs must be removed prior to operation of the battery. The Bunson valves, included with the battery in a separate plastic bag, should then be screwed into the vent cap assembly in place of the screw plugs. The Bunson valves will release excessive pressure from gas accumulation to prevent cell rupture.

NOTE

On batteries not equipped with the screw-type plugs and Bunson valves, remove the shipping plugs and clean the filler cap vent plugs as noted under CLEANING AND INSPECTION. Retighten the cell vents with the vent plug wrench included with the battery.

c. Check for a torque of 6 foot-pounds on the terminal screws securing the cross links connecting the cells together.
d. Before charging, determine that all cells are properly installed by making a cumulative voltage check.
e. After determining the battery is in good physical condition and is properly assembled, it should be charged as outlined under BATTERY CHARGING and the electrolyte level adjusted.

BATTERY INSTALLATION

a. Place the battery in the well, install the battery hold-down bar and the two nuts. Safety wire the nuts.

MAINTENANCE LOG

Catalog No. ____________________ Serial No. ____________________

Date Installed ____________________ On ____________________

REMOVAL DATE AND REASON	GENERAL CONDITION			END OF CC CHARGE VOLTAGE RANGE		ELECTROLYTE LEVEL	ELECTRICAL LEAK CHECK	CAPACITY	REMARKS
M — Maintenance F — Failure (Indicate Type)	Case and Cover	Hardware and Liners	Cells and Vents	Lowest Reading Minimum 1.50	Highest Reading Maximum 1.70				Indicate: Average water added, hardware or cell replacements, burns or discolorations, etc.

b. Connect the battery vent tubing.

c. On serials P-226 and after, connect the cooling ducts.

d. Install the battery quick-disconnect and safety wire.

e. Reinstall the upper access door aft of the LH nacelle firewall.

BATTERY CHARGING

The two basic methods of charging nickel-cadmium batteries are the constant potential and constant current methods. Variations of the two basic methods may be incorporated in automatic equipment.

WARNING

Complete servicing of the battery is required if the battery is subjected to more than 32 volts for 2 minutes.

SPECIAL NOTES ON CHARGING

The following special comments are made with respect to charging nickel-cadmium batteries:

a. Charging is most efficient at battery temperatures between 40°F and 80°F.

b. Two or more batteries may be charged in parallel on a constant potential charging bus, provided the charging equipment has the proper current producing capability.

c. Do not charge batteries in parallel using the constant current method.

d. Do not charge individual cells unless the plastic case is supported on each side. A special frame may be built to fit the cell, or two boards or plates may be placed on each side of the cell and held together by a C-clamp. The sides of the cell must be kept flat during charging.

e. Perform necessary inspection, cleaning and repairs before charging.

f. Do not energize charging equipment until after the battery has been connected to the charging circuit.

g. When charging a battery in the shop, a thermometer should be placed so that the bulb is below and between the top of the cells. Do not place on charge any battery that has a temperature of 100°F or higher.

h. The foam sometimes seen in cells during charging does not indicate a defect. Foaming usually occurs after water is added and will disappear after a few cycles of operation.

The various charging procedures for the nickel-cadmium battery are outlined in the following paragraphs:

CONSTANT CURRENT CHARGING

CAUTION

Monitor the battery closely during charging (especially during the latter stages) to prevent an overcharge that will heat up and damage or destroy the battery.

AIRCRAFT BATTERY INSTALLATION CHECKLIST

- ○ *INSPECT FOR VISIBLE DAMAGE*
- ○ *REMOVE SHIPPING HARDWARE*
- ○ *ENSURE THAT ALL CONNECTORS ARE PROPERLY TIGHTENED*
  (Do not level electrolyte on new battery prior to charging.)
- ○ *CONNECT BATTERY CORRECTLY TO CHARGER*
- ○ *CHARGE BATTERY (Constant current recommended)*
- ○ *MEASURE END-OF-CHARGE VOLTAGE*
- ○ *REST BATTERY 2 TO 4 HOURS*
- ○ *CHECK ELECTROLYTE LEVEL*
- ○ *CLEAN AND CHECK AIRCRAFT'S BATTERY CONNECTOR*
- ○ *INSTALL BATTERY*
- ○ *CHECK AIRCRAFT'S BATTERY CHARGER SYSTEM*

PREVENTIVE MAINTENANCE CHECKLIST

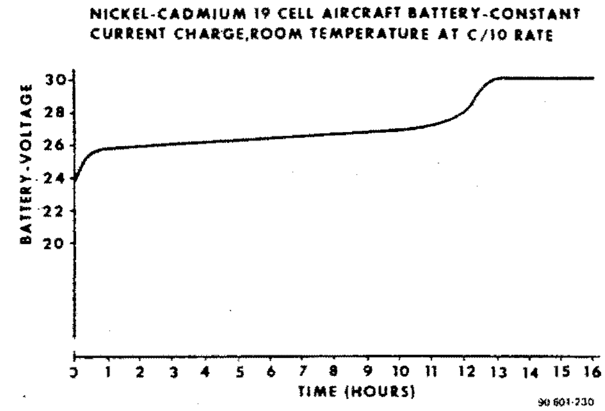
- ○ *CLEAN BATTERY*
- ○ *INSPECT FOR VISIBLE DAMAGE*
- ○ *WASH VENT CAPS*
- ○ *RECONDITION*
    - ○ *DISCHARGE AND SHORT*
    - ○ *CONSTANT CURRENT CHARGE*
    - ○ *MEASURE END-OF-CHARGE VOLTAGE*
- ○ *REST BATTERY 2 TO 4 HOURS*
- ○ *LEVEL ELECTROLYTE*
- ○ *MEASURE ELECTRICAL LEAKAGE*
- ○ *DISCHARGE, MEASURING CAPACITY*

Although slower, the constant current method is the recommended way of charging the battery. Most shops are equipped with constant current chargers. In cases where the chargers are limited to 6 ampere capability, it will be necessary to start the charge of most batteries at a lower rate than recommended on the battery nameplate. If a reduced rate is used, a longer charging time is required. The constant current method is much more effective in correcting cell imbalance and temporary loss of capacity, and it permits easy computation of the charge capacity in ampere-hours. When using this method, one must usually monitor and maintain the constant current by manually adjusting the charger.

The following procedures for constant current charging are generally applicable to all aircraft nickel-cadmium storage batteries:

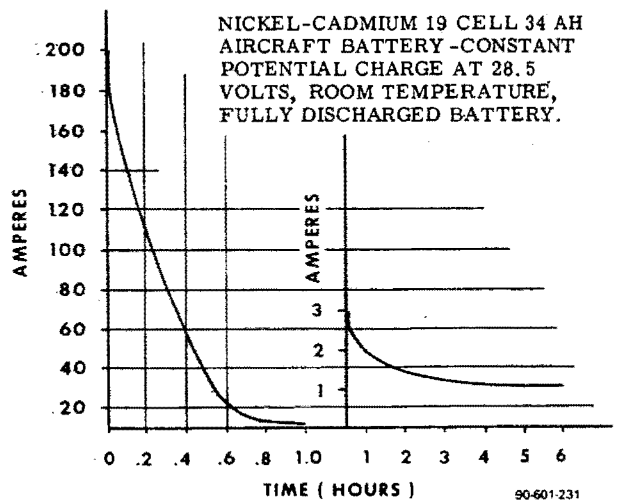
a. The time required to charge a nickel-cadmium storage battery varies with respect to the discharging current, capacity rating, and amount of charge already in the battery. If fully discharged, the battery should be charged to 140 percent of its nominal ampere-hour rating.

b. When using the constant current method of charging, the battery may be charged in two steps by using the START rate of current and the FINISH rate of current. (Lower starting rates may be used if required by such factors as equipment limitations.) These rates are usually given on the battery nameplate. The two step method is commonly used by the military. Single rates, slow or fast, are usually preferred by commercial service shops because of their simplicity. The single fast charging rate is 2.7



Constant Current Charge at C/10 Rate
Figure 201

amperes per hour for the 13.5 ampere-hour battery for seven hours. The slow charging rate is 1.4 amperes per hour for the 13.5 ampere-hour battery for 14 hours. See Figure 201 for slow (capacity/10), single rate, constant current charging voltage. A battery is charged at the START rate until the battery temperature takes a sharp rise or until the terminal voltage (while battery is charging) reaches 29.5 volts (for a 24-volt 19-cell battery). When the 29.5 volt point is reached or the temperature takes a sharp rise, the charging current is reduced to the FINISH rate and continued until one-third of the initial charge in ampere-hours is added. When the voltage rises to 29.5 volts, the charge received by the battery is approximately equal to that removed when it was previously discharged. The addition of ampere-hours at the FINISH rate equal to one-third of the ampere-hour input at the START rate will usually ensure that the battery is fully charged.



Constant Potential Charging
Figure 202

c. The time required for completing the charge at the FINISH rate may be computed by the following formula:

$$T_F = \frac{I_S \times T_S}{3 \times I_F}$$

T_F = Time, in hours, required for finishing charge.

I_S = Starting charge rate in amperes.

T_S = Time, in hours, of charge at the starting rate until 29.5 volts or temperature rise occurs.

I_F = Finish rate in amperes.

As an example, assume that a 20 ampere-hour battery is charged at a start rate of 8 amperes for 2 hours, at which time the voltage rises to 29.5 volts. The ampere-hour input at the start rate is then $I_S \times T_S$ = 16 ampere-hours. The ampere-hours of additional charge required are $(I_S \times T_S)/3 = T_F \times I_F = 16/3 = 5.3$. If a finish rate of 2 amperes is used, the finish rate charge time will be:

$$T_F = \frac{I_S \times T_S}{3 \times I_F} = \frac{16}{3 \times 2} = 2.7 \text{ hours}$$

d. While the battery is being charged, the charging current should be kept constant at the rate being used. If the battery charger is not a self-regulating type, this operation can be achieved by manually adjusting the charger on a periodic basis.

e. During the finish charge, the individual cell voltages should be measured with a precision voltmeter to determine if all cells are rising evenly. Should some cells indicate a voltage lower than the others by .05 volts or more, it is advisable to leave the battery on charge a while longer for additional equalization. Do not allow the battery to overheat.

CONSTANT POTENTIAL CHARGING

Nickel-cadmium batteries can be charged much faster by the constant potential method, but the charging time will depend on the current-delivery capability (300 ampere generators are good charging sources). A disadvantage of constant potential charging is that full capacity cannot normally be restored if a battery suffers from temporary loss of capacity. It should also be noted that such a loss of capacity is quite common in batteries after prolonged use in the aircraft.

a. Vented, 19-cell, 24-volt, nickel-cadmium batteries will normally be charged at 28.5 volts in the shop when charging with a constant potential voltage. Note that charging a 19-cell battery at 28.5 volts is equivalent to charging each cell at 1.50 volts. The initial charging current may be as high as 10 times the ampere-hour rating of the battery, depending on the amount of charge already in the battery. The high initial current will not damage the battery, but the charging equipment should have an inherent current-limiting capability or be provided with overload protection.

b. The time required to charge will depend primarily on the current-delivery capability of the charging unit. The lower the charging current, the longer the time required to charge. If the battery does not suffer from temporary loss of capacity, nearly full charge (approximately 90 percent of rated capacity) may be restored within 1 hour at 28.5 volts charging potential, provided the charging equipment is also capable of delivering current equal to 2 to 3 times the ampere-hour rating of the battery. (See Figure 202.)

CAUTION

When a battery is connected to a constant potential charging source, the initial high charging current will damage any 0-25 or 0-50 ampere-scale ammeter connected in series with the battery.

c. An ammeter with a range of zero to 25 or zero to 50 amperes should be connected in series with the battery and power source to monitor the charging current when the master generator panel meter indicates that the current has dropped sufficiently. Charging should continue until the ammeter indicates a current flow of 1 ampere or less, or until a maximum time of 4 hours has elapsed.

d. Should a battery be severely discharged, charging by the constant potential method may produce a slight imbalance in cell capacity. The imbalance can be detected by a periodic check of the cell terminal voltages with a precision voltmeter after the charging current levels off to a few amperes while the battery is charging. Should some cells differ from others by more than .05 volts, connect the battery to a constant current source and charge for 14 hours at a rate of 1.4 amperes on a 13.5 ampere-hour battery. If the cells still fail to equalize, perform an equalization charge.

BATTERY STAND-BY CHARGING

Since the self-discharge rate of a nickel-cadmium battery is approximately 1.2 percent per day at normal temperatures, standby charging is required to maintain a battery at its full rated capacity. For standby charging in the temperature range of 60°F to 90°F, use a current equal to .003 ampere per each ampere hour of rated capacity. Batteries on stand-by charge must be regularly checked to ensure adequate electrolyte level.

CAPACITY RECONDITIONING

The capacity of a nickel-cadmium battery does not decrease appreciably with age. However, there can be a temporary loss of capacity under certain duty cycles. A temporary loss of capacity is normally an indication of imbalance between cells. Imbalance can be caused by differences in temperature, charge efficiency, self-discharge rate, etc. The purpose of reconditioning is to restore a battery to its full capability and to prevent premature damage and failure. Effective reconditioning requires specific procedures for certain periods of time. No step in the procedure can be eliminated nor can any time period be shortened and still yield effective battery reconditioning.

FREQUENCY OF RECONDITIONING

Due to the variables involved in usage, it is impossible to establish a time interval for reconditioning that will cover all batteries. Until service experience dictates otherwise, a visual and electrolyte check of the battery should be made after the first 50 hours of flight. If the condition of the battery is normal and the level of electrolyte in the battery is satisfactory, schedule the initial reconditioning at 100 hours. Repeat the reconditioning procedure outlined below at 100-hour intervals until servicing experience justifies a change.

NOTE

The log of battery services performed should be evaluated to determine the need for servicing the battery at the above recommended intervals or extending the intervals. Accurate water consumption data is a valid barometer to use for adjustment of the servicing intervals.

RECONDITIONING PROCEDURE

a. Discharge the battery at a current equal to or less than the one-hour rate. Short out each cell as it drops below .5 volts. The cells may be shorted by clips or by wires having clips on each end. Allow the shorts to remain on the cells for a minimum of 16 hours, and preferably for 24 hours.

b. Remove the shorting clips and charge for 24 hours at 1.1 amperes for a 13.5 ampere-hour battery. After approximately 5 minutes of charge, measure the individual cell voltages. If any cell voltage is greater than 1.50 volts, add distilled water. The amount of water required is approximately 1 cc per rated ampere-hour capacity, for example, a 13.5 ampere-hour cell may require about 13.5 cc of water at this time.

c. After approximately 10 minutes of charge, remeasure the cell voltages. Replace any cell that measures below 1.20 volts or above 1.55 volts.

d. Continue charging for 20 hours. After 20 hours of charging, measure and record the individual cell voltages. If necessary, add distilled water to level the cell 1/8 to 1/4 inch above the baffle. Do not remove any electrolyte from the cells.

e. Measure and record the voltage at 24 charge hours and compare with the 20 hour reading. If the 24 hour voltage reading is below the 20 hour reading by more than .04 volts, replace the cell. Also replace any cell that measured below 1.50 volts at 24 charge hours. After removing the battery from charge, measure the electrolyte temperatures. If the electrolyte temperature of any cell is greater than 30°F above the ambient, replace that cell.

BATTERY ELECTROLYTE LEVEL ADJUSTMENT

Although the electrolyte level in the nickel-cadmium battery varies with the state of charge, it should be visible above the bottom of the baffle when the battery is fully charged. When the state of charge of the battery is low, the plates absorb some of the electrolyte, then release it as the battery is recharged. The electrolyte level on any battery must be adjusted after a full charge and a two to four hour rest on open circuit. Check the electrolyte level of the battery (fully charged) in the following manner:

CAUTION

Never use acid or tools contaminated with acid during this adjustment, for both bodily injury and equipment damage may result. If possible, use equipment reserved for nickel-cadmium batteries. If lead-acid battery equipment must be used, remove all possible acid contamination with a sodium bicarbonate solution and rinse. Even minute traces of acid can damage a nickel-cadmium battery.

a. Remove the battery from the aircraft.

b. With the battery removed from the aircraft, remove the filler cap vent plug on each cell, one cell at a time.

c. Insert a transparent tube (approximately 6 inches long and 1/4 inch in diameter) perpendicularily into the filler well until the open end rests lightly on the cell baffle, then place the index finger over the top open end and withdraw the tube.

CAUTION

Do not push down, for the light material of the baffle will give enough to result in a false indication of the electrolyte level.

d. The electrolyte level of a fully charged battery should be between 1/8 and 1/4 inch above the bottom of the baffle. If the level of liquid in the tube exceeds 1/4 inch, remove the excess with a syringe or squeeze bottle. If the level of the electrolyte is less than 1/8 inch above the bottom of the baffle, add distilled water with a syringe or squeeze bottle.

CAUTION

Tap water contains minerals, chlorines, softening agents, and other foreign materials which will contaminate a storage battery and shorten its life.

WARNING

The battery may be damaged if the proper procedure is not followed when adding distilled water to the cells.

e. Clean and reinstall the filler cap, vent cap, vent plugs and check the battery terminal links for tightness. Discolored links or melted nylon around cell terminals indicate loose link connections.

CAUTION

If water or electrolyte is spilled into the battery container, the resultant electrolyte corrosion may cause battery failure. The battery case must be cleaned as instructed in CLEANING AND INSPECTION.

ELECTRICAL LEAKAGE CHECK

The self (internal) discharge rate of a vented nickel-cadmium battery cell is in the order of C/1000 when fully charged. "C" in this formula represents capacity in ampere-hours. This is about 13.5 ma for 13.5 ampere-hour batteries. The only pertinent measure of external leakage is the rate of discharge caused by the leakage. The rate is significant only when it approaches the rate of internal leakage. Therefore, external leakage need be considered excessive only when an ammeter shorting the battery positive or negative terminal to the battery case indicates 13.5 ma or more on 13.5 ampere-hour batteries. Any current less than the preceding limits indicates a magnitude of leakage that has a negligible effect on battery performance.

Perform the following test to determine if external leakage is sufficient to necessitate cleaning the battery. Set the range selector of a multi-range ammeter to the 500 ma scale or higher (a low cost meter is recommended to preclude possible damage to an expensive precision meter). Connect the positive terminal of the ammeter to the positive battery terminal and the negative ammeter terminal to the battery case. Decrease the ammeter current range to obtain a readable value of current and record the value. Perform the same measurement at the negative battery terminal by connecting it to the negative terminal of the ammeter and connecting the positive terminal of the ammeter to the battery case. If the current reading at either terminal is more than 13.5 ma on 13.5 ampere-hour batteries, the battery should be cleaned. This test should be made again after the battery has been completely cleaned and charged. If the current measure is again more than 13.5 ma on 13.5 ampere-hour batteries, it may be assumed that one of the cells has a seal leak. That cell may be found by measuring connector-to-battery case voltages. The lowest voltages will occur at the connectors on each side of the defective cell. A cell found leaking in this manner should be replaced.

CAPACITY CHECK

a. Discharge the battery at a rate of 6.0 amperes on 13.5 ampere-hour batteries until an average voltage of one volt per cell is reached. Measure the time required for the battery to reach that discharged state. Any battery that discharges to one volt per cell in 84 minutes or less should be given another reconditioning (deep) cycle.

b. After the second reconditioning cycle, recheck the battery capacity by discharging at the rate used in step "a". Measure the individual cell voltages after 84 minutes of discharge. If any cell is below one volt, replace it.

CLEANING AND INSPECTION

a. Scrub each cell with a 5 percent solution of boric acid in water, but take great care to prevent the solution from entering the cell.

b. Wash each cell off under running water and dry with an air hose or clean absorbent towel.

c. Inspect each cell for defects such as cracks, holes, or burn spots. Replace defective cells with new or rebuilt cells.

d. Make sure that battery hardware is clean and in good mechanical condition. Wash the hardware, liners, case, cover, and other associated parts in a warm soapy solution to remove accumulated dirt and carbonate deposits. Use a stiff brush to remove heavy deposits. After washing, rinse the parts free of soap and spread them out to dry.

e. Remove corrosion preventive from connectors, screws, nuts, and washers with alcohol or by degreasing.

f. Wash vent caps thoroughly with hot water and no soap.

g. After the parts are dry, sort out damaged or heavily corroded pieces. Scrap any links having burns, bends, or defective nickel plating. If a link is tarnished at the terminal connection, it should be polished with a wire brush. It is recommended that new terminal screws and nuts be used to ensure proper electrical connection.

h. Check the battery receptacle for burns, cracks, and bent or pitted terminals. Defective receptacles can overheat, cause arcing, and decrease output voltage to result in premature battery failure.

i. Scrap bent or torn battery cases and covers that are beyond repair.

j. Replace or repair loose or damaged cover gaskets and cell holddown bars.

NOTE

Refer to the maintenance manual of the battery manufacturer for additional details on battery disassembly and assembly.

BATTERY MAINTENANCE PROGRAM (P-446 and after)

A systematic battery maintenance program should be established and carefully followed.

a. The batteries should be removed from the airplane for service.

b. A log of the services performed on each battery should be maintained.

c. The battery should be removed from the airplane and serviced after: 100 flight hours or 30 days, whichever occurs first. If the ambient temperatures are above 90°F or the time between engine starts averages less than 30 minutes, the duty cycle should be reduced.

d. The log of battery services performed should be evaluated to determine the need to service the batteries at the above recommended intervals or to extend the intervals if justified. Accurate water consumption data is a valid barometer to use for adjustment of the servicing intervals.

BATTERY REMOVAL

a. Remove the upper access door to the electrical equipment compartment aft of the left nacelle firewall.

b. Remove the nuts from the hold-down strap bolts.

c. Release the battery box lid latches and remove the box lid.

d. Remove the NEGATIVE battery cable from the batteries.

CAUTION

Always remove the ground cable terminal first and install it last to prevent accidental short circuits.

e. Remove the POSITIVE cable terminal from the batteries.

f. Remove the bus bar interconnect from the two batteries.

g. Remove the batteries from the airplane.

BATTERY INSTALLATION

a. Position the batteries in the battery box.

b. Coat the battery terminals and cable terminals with a light coating of petroleum jelly.

CAUTION

If the POSITIVE battery terminal is not marked +, POS or painted red and the NEGATIVE battery terminal is not marked −, NEG or painted black, use a voltmeter to determine the battery polarity before connecting the battery in the airplane. Reverse polarity will destroy the diodes and other electronic components in the electrical system.

c. Position the POSITIVE cable terminal on the battery and secure.

d. Position the NEGATIVE cable terminal on the battery and secure.

e. Install the bus bar interconnect on both batteries.

f. Remove any excess petroleum jelly from the terminals.

g. Position the battery box lid on the battery box and secure.

h. Install the nuts on the hold-down strap bolts.

i. Install the access door.

BATTERY CLEANING

For peak performance, the batteries must be kept clean and dry. If foreign materials are present in sufficient quantities, the resultant deposits may form conductive paths that permit a rapid discharge of the batteries. To prevent the collection of such deposits, use the following steps in cleaning the batteries after each 100 hours of service or every 30 days, whichever occurs first:

a. Remove the batteries as described in the section BATTERY REMOVAL.

b. Ensure that the battery cell filler caps are tight in place. Brush dirt off with a stiff bristle brush.

CAUTION

Never use a wire brush or brush with a metal construction for this purpose as short circuiting or other damage may result.

c. Scrub the batteries with a solution of ammonia or bicarbonate of soda (one part of soda to a gallon of water). This will neutralize any electrolyte sprayed or spilled out.

CAUTION

Entrance of ammonia or soda solution into a battery cell will neutralize the cell electrolyte. Never use solvents to clean the batteries, for these may damage the battery case.

d. Rinse the batteries with clear water, then sponge off the excess water. Allow the batteries to air-dry.

e. Wash the battery filler caps with clean hot water and no soap, then examine the vent holes in the battery filler caps to make sure they are clear.

f. Inspect the battery for cracks, holes or burn spots. Replace if necessary.

g. Make sure that all batteries hardware is clean and in good mechanical condition.

NOTE

If additional cleaning of the battery terminals and cable terminal is required, use a wire brush and brighten up the terminals to ensure a good electrical connection.

BATTERY BOX CLEANING

The battery box is vented overboard to dispose of electrolyte and hydrogen gas fumes discharged during normal charging operation. To ensure the disposal of these fumes, the vent hose connections at the battery box should be checked frequently for obstructions. The battery box should be washed out thoroughly and dried each time the battery is removed and cleaned.

BATTERY SERVICING

The batteries should be maintained in a fully charged state at all times and the electrolyte level checked at regular intervals. Clean fully charged batteries will provide peak performance. Never add anything but distilled water when adjusting the electrolyte level in the batteries. If electrolyte is added each time the level in the batteries are low, a high concentration of electrolyte may cause dissolution of the plates. Under high temperature conditions, this may be indicated by the presence of black particles in the electrolyte of the affected cells.

NOTE

Do not fill the batteries over one-half inch above the separators. Only lead-acid equipment should be used when servicing lead-acid type batteries.

RECHARGING BATTERIES USING AUXILIARY POWER

The following steps should be used in using auxiliary power to recharge the battery:

a. Place the battery master switch in the on position.

b. Place both alternator switches and all electrical and avionics equipment switches in the off positions.

c. Connect the auxiliary power unit to the external power receptacle.

CAUTION

Make certain that the battery switch is in the on position, all avionics and electrical switches are in the off positions and batteries are in the system before connecting an external power unit. This protects the electrical voltage regulators and associated electrical equipment from voltage transients (power fluctuations).

d. Set the output of the auxiliary power unit at 27.0 to 28.5 vdc.

e. Place the auxiliary power unit in the on position.

If the battery master relay will not close, the batteries must be removed from the airplane for recharging. Check the battery master relay control circuit for a malfunction.

"END"

DC GENERATION-MAINTENANCE PRACTICES

BATTERY CHARGE CURRENT DETECTOR SYSTEM FUNCTIONAL CHECK (Prior to P-446)

NOTE

Satisfactory load change as used herein, is defined as deflection of the loadmeter needle equal to or less than a .025 load change (approximately 3 amperes) for airplanes with a 13.5 ampere-hour battery. A load change of .025 or .050 is barely perceptible.

The system may be checked in the airplane with either engine running. After the engine is started, turn the applicable generator ON. After a time delay of approximately 6 seconds (provided the battery is sufficiently discharged and will accept a charge), the amber caution light (BATTERY CHARGE) located on the instrument panel should illuminate. The light should remain illuminated until the battery is recharged. Under normal circumstances, the battery should be recharged and the light should go out within 5 minutes. However, if the battery has had unusually low or high drain, the recharge time could be considerably shorter or longer. When the light does go out, turn the battery switch OFF while observing the affected loadmeter; the loadmeter should indicate a satisfactory load change.

Listed below are possible situations that could be experienced and corresponding action that is recommended:

a. Light does not illuminate - If the bulb is operational but the light does not come on within approximately 6 seconds after the operating generator is turned ON, it is possible that the battery is not sufficiently discharged to accept a charge. This can be determined by turning the battery OFF while observing the loadmeter needle deflection. A satisfactory load change indicates the battery is charged and the light should not be on. An unsatisfactory load change indicates the light should be on and that there is a malfunction in the detector system. Repair or replace the defective parts and repeat the functional check. If the battery was not discharged enough to accept a charge, turn the generator OFF and partially discharge the battery by operating electrical equipment. Repeat the functional check.

b. Light stays on - Check the following possibilities:

1. Battery is partially discharged and is charging. If the light stays on after charging for approximately 5 minutes, careful attention should be given the airplane loadmeter. With a constant load on the airplane electrical system, continue to charge the battery. The loadmeter should indicate a constantly decreasing charge current until the battery is charged. When the loadmeter appears to stabilize (see NOTE in condition 2 below), turn the battery OFF while observing the loadmeter for load change. If the load change is satisfactory and the light has gone out, the battery is charged and the system is operating properly.

2. Battery is charged and is being excessively overcharged. If the loadmeter stabilizes and indicates an unsatisfactory load change when the battery is turned OFF, the battery is overcharging excessively and the light should not have gone out. Check the battery and charging circuit for condition and proper operation.

NOTE

As the battery approaches full charge, the charge current may decrease slowly enough that the loadmeter would appear to stabilize before the charge current has decreased enough for the light to go out.

In the event of doubt as to the amount of charge current after the loadmeter appears to have stabilized, an ammeter can be integrated into the charging circuit. Install the ammeter and check the charge current as follows:

(a) An ammeter that will indicate approximately 10 amperes, lead lines that will reach from the battery relay to the pilot's compartment and an on-off switch for the ammeter leads will be required.

(b) Wire the on-off switch into one of the leads and connect the leads to the ammeter.

(c) Connect the negative side of the ammeter to the battery side of the battery relay and the positive side of the ammeter to the generator side of the battery relay.

(d) With the switch in the ammeter lead turned off, start either engine. Allow the battery to charge until the loadmeter appears to stabilize.

(e) Turn the switch in the ammeter lead on and turn the battery switch OFF, in that order to prevent a current surge and possible damage to the ammeter.

(f) Note the charge current as indicated on the ammeter. The charge current should decrease until the light goes out at approximately 3 or 7 amperes and may continue to decrease to a lower level.

Repair or replace any parts found to be defective and repeat the functional check.

3. Battery is charged and is not being excessively overcharged. If the light is on and the charge current has dropped to a satisfactory level, the detector assembly is malfunctioning and should be replaced.

(a) Light is erratic or does not operate in unison with suitable charge current values as previously outlined. Check the wiring and detector assembly for proper operation. Repair or replace defective parts and repeat the functional check.

"END"

EXTERNAL POWER - MAINTENANCE PRACTICES

The aircraft electrical system is protected against damage from reverse polarity by a relay and diodes in the external power circuit. The external power receptacle is located just outboard of the left engine nacelle. The receptacle is designed for a standard AN type plug. To supply power for ground checks and air conditioner operation, a ground power source capable of delivering a continuous load of 300 amperes at 24 to 30 volts is required. Use of an inadequate ground power unit can cause a voltage drop below the drop-out voltage of the starter relay, resulting in relay chatter and welded contacts. By the same token, a maximum continuous load in excess of 350 amperes will damage the external power relay and power cables of the aircraft.

Observe the following precautions when using an external power source:

a. Use only an auxiliary power source that is negatively grounded. If the polarity of the power source is unknown, determine the polarity with a voltmeter before connecting the unit to the aircraft.

b. Before connecting the external power unit, turn off all radio equipment and generator switches, but leave the battery on to protect transistorized equipment against transient voltage spikes.

CAUTION

When the battery switch is turned OFF for extended ground power operation, place an external battery in parallel with the output of the external power unit before operating any transistorized avionics equipment.

c. If the unit does not have a standard AN plug, check the polarity and connect the positive lead from the external power unit to the center post and the negative lead to the front post of the aircraft's external power receptacle. The small pin of the receptacle must be supplied with + 24 VDC to close the external power relay that provides protection against damage by reverse polarity.

"END"

ELECTRICAL LOAD DISTRIBUTION - MAINTENANCE PRACTICES

The dual bus feeder diodes should be inspected at 600 flight hour intervals as instructed under PERIODIC INSPECTION OF DUAL BUS FEEDER DIODES. Whenever the dual bus has been modified or extensive repairs have been made that could result in the dual bus loops being interconnected or open, it is necessary to perform a DUAL BUS CONFORMITY INSPECTION. This will ensure that the original design of the dual bus is maintained.

PERIODIC INSPECTION OF DUAL BUS FEEDER DIODES (Figure 202)

An open or shorted dual bus feeder diode cannot be detected during the normal operation of the aircraft electrical system. Should a malfunction occur which would cause a bus isolation limiter to open, such as a ground fault on a generator bus, an open dual bus feeder diode could not supply power to its respective dual bus loop. A shorted diode would not isolate its respective dual bus from a ground fault. The inspection procedure outlined here will ensure the dual bus capability. The inspection may be performed at a normal periodic inspection of the aircraft and either battery power or an auxiliary ground power unit connected to the external power receptacle may be used. A suggested inspection procedure follows:

a. Remove all power from the aircraft.

b. Open the four 50 ampere bus feeder circuit breakers labeled ELECTRICAL POWER on the right circuit breaker subpanel.

c. Turn the battery and/or auxiliary ground power unit ON.

d. Confirm the continuity of each dual bus feeder diode. This may be accomplished by closing a single ELECTRICAL POWER feeder diode circuit breaker and confirming the presence of voltage on the corresponding dual bus loop. The presence of voltage may be determined by the operation of circuits which receive power from the dual bus loop. Refer to the Power Distribution Schematic, Figure 202, or to the applicable wiring diagram for the appropriate aircraft serial in the Wiring Diagram Manual, 60-590001-29, to determine which circuits receive power from each dual bus loop. Repeat for each circuit breaker.

e. Confirm that each dual bus is not shorted. This may be accomplished by closing a single ELECTRICAL POWER feeder circuit breaker and determining that no voltage is present at the load side of each of the three remaining ELECTRICAL POWER feeder circuit breakers. Repeat for each circuit breaker.

Should any diode prove to be either shorted or open, this diode must be replaced and the inspection repeated. After completion of the inspection, reset all circuit breakers and tighten all connections securely. Ensure that all wires and terminals are not chafing against the aircraft structure. Check the system for normal operation.

DUAL BUS CONFORMITY INSPECTION (Figure 201)

A dual bus conformity inspection shoud be performed whenever the console or subpanel bus system has been modified or whenever repairs have been made that may result in the dual bus loops being interconnected or open. Either battery or auxiliary power may be used when conducting this inspection. Check for correct circuit connections by actual operation of the circuit as described by the appropriate power distribution circuit in the Wiring Diagram Manual, P/N 60-590001-29. The conformity inspection may be performed as follows:

a. Open the four 50 ampere bus feeder circuit breakers labeled ELECTRICAL POWER on the right circuit breaker subpanel.

b. Turn the battery ON. External power may be used.

c. Close the LH # 1 bus feeder circuit breaker, check each circuit and record the results.

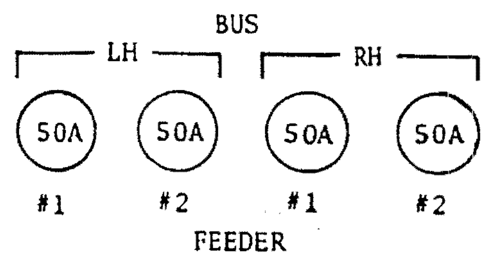
d. Open the LH # 1 bus feeder circuit breaker and close the LH # 2 bus feeder circuit breaker. Repeat the circuit checks and record the results.

e. Open the LH # 2 bus feeder circuit breaker and close the RH # 1 bus feeder circuit breaker. Repeat the circuit checks and record the results.

f. Open the RH # 1 bus feeder circuit breaker and close the RH # 2 bus feeder circuit breaker. Repeat the circuit checks and record the results.

g. If any of the results that have been recorded reveal a discrepancy, locate and repair to obtain the desired result.

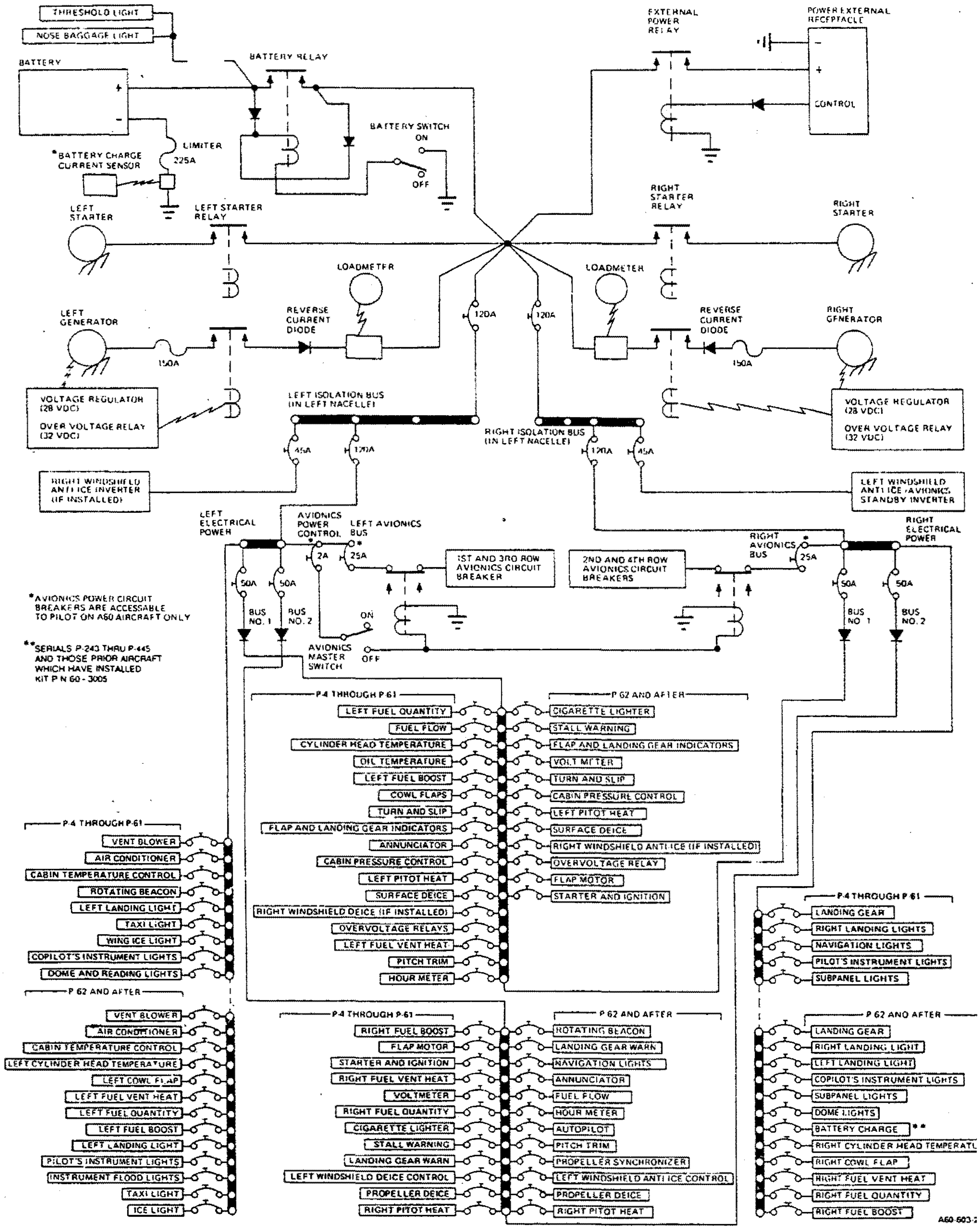
h. Close all circuit breakers and return the aircraft to normal.



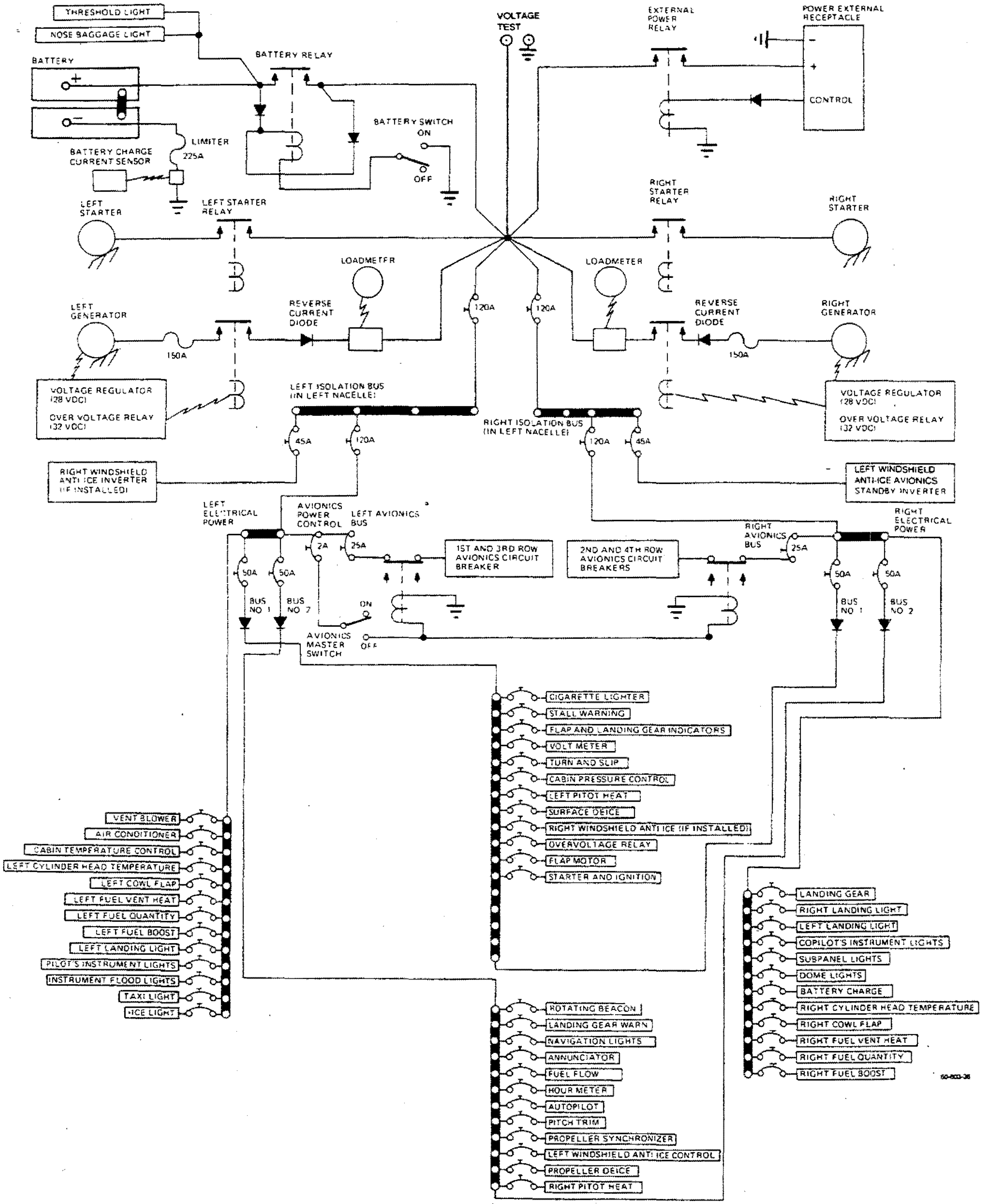
Dual Bus Conformity Inspection
Figure 201

ELECTRICAL UTILIZATION LOAD CHART

The following chart provides information pertaining to the capacity of the generator for supplying the electrical load on the aircraft while maintaining a full charge on the battery. To determine the total electrical load of the aircraft, add the continuous load for standard equipment to the load of the optional equipment installed in the aircraft (accessories and radio). Since the aircraft is equipped with two 28 volt, 125 ampere generators, the total load shall not exceed 80 percent of the total generating capacity. When an item of equipment functions at various times in different systems, the load per unit value listed in the chart represents the highest value required to operate that particular unit in the various systems in which it functions.



Power Distribution Schematic (P-4 thru P-445)
Figure 202



Power Distribution Schematic (P-446 and after)
Figure 203

CHART 201
ELECTRICAL UTILIZATION LOAD

	Number Per Aircraft	Load Per Unit In Amps.	Load Per Aircraft In Amps.
CONTINUOUS LOAD-STANDARD EQUIPMENT			
Battery Relay	1	0.60	0.60
Cabin Pressure Control System			
Ram Air Magnetic Door Catch	1	0.21	0.21
Isobaric Control Valve	1	0.90	0.90
Cabin Pressure Differential Control Valve	1	0.50	0.50
Cylinder Head and Oil Temperature System			
Cylinder Head Temperature Indicator	2	0.49	0.98
Oil Temperature Indicator	2	0.31	0.62
Flap Position System			
Flap Position Indicator	1	0.001	0.001
Flap Position Printed Circuit Board	1	0.059	0.059
Fuel System			
Fuel Flow Indicator Inverter	1	0.94	0.94
Fuel Quantity Indicator	2	0.05	0.10
Fuel Vent Heater	2	1.35	2.70
Heater System			
Vent Blower	1	17.00	17.00
* Vent Blower Relay	2	0.35	0.35
Combustion Air Blower	1	2.90	2.90
Manual or Automatic Select Relay	1	0.09	0.09
Heater Cycle Control Relay	1	0.09	0.09
Heater Fuel Pump	1	0.40	0.40
Remote Heater Solenoid Valve	1	0.33	0.33
Heater Assembly	1	1.30	1.30
Combustion Air Select Valve	1	0.63	0.63
Heater Safety Relay	1	0.09	0.09
Cabin Temperature Control Box	1	0.18	0.18
Cabin Air Sensing Element	1	0.25	0.25
Pitot Heater (LH)	1	3.30	3.30
Turn and Slip Indicator	1	0.15	0.15
Voltmeter	1	0.001	0.001
Lighting			
Dim Switches	8	0.05	0.40

*Only one used at a time.

CHART 201
ELECTRICAL UTILIZATION LOAD (Cont'd)

	Number Per Aircraft	Load Per Unit In Amps.	Load Per Aircraft In Amps.
CONTINUOUS LOAD-STANDARD EQUIPMENT			
Lighting (Cont'd)			
Edge Lights	163	0.04	6.52
Cabin Altitude Warning Light	2	0.04	0.08
Cabin Door Warning Light	2	0.04	0.08
Annunciator Lights Dim Relay	1	0.09	0.09
Inverter Out Light	2	0.04	0.08
* Landing Gear Position Lights			
Landing Gear Uplock Light	1	0.04	0.04
Landing Gear Down Lock Light	3	0.04	0.12
Compass Light	1	0.04	0.04
Engine Instrument Lights	10	0.04	0.40
Instrument Flood Lights (Red)	10	0.17	1.17
Instrument Flood Lights (White)	8	0.17	1.36
Outside Air Temperature (Post Light)	1	0.04	0.04
Pilot's Clock Light	1	0.04	0.04
Pilot's Instrument Lights (Post Light)	18	0.04	0.72
Pilot's Map Light	1	0.17	0.17
Reading Lights	6	0.30	1.80
Navigation Lights (Wing)	4	0.75	3.00
Navigation Light (Tail)	1	0.65	0.65
Rotating Beacon (Lower)	1	3.10	3.10
Rotating Beacon (Upper)	1	3.10	3.10
CONTINUOUS LOAD-OPTIONAL EQUIPMENT			
Air Conditioner			
Combustion Blower	1	2.90	2.90
Condenser Blower	1	15.00	15.00
Condenser Blower Relay	1	0.35	0.35
Cabin Temperature Control Box	1	0.17	0.17
Cabin Air Sensing Element	1	0.25	0.25
Heating or Cooling Temperature Control Relay	1	0.09	0.09
Hot Gas By-pass Solenoid Valve (P-4 through P-126, except P-123)	1	0.75	0.75
Solenoid Valve Timer	1	0.06	0.06
Magnetic Clutch	1	2.00	2.00
Nacelle Scoop Relay	1	0.35	0.35
Vent Blower	1	17.00	17.00
**Vent Blower Relay	2	0.35	0.35
Propeller Deice System	1	18.00	18.00
Pitot Heater (RH)	1	3.30	3.30
Cabin Air Inlet Deice Boot	1	2.50	2.50
Flight Hour Meter	1	0.02	0.02
Engine Hour Meter	1	0.02	0.02
Generator Control System			
Overvoltage Relay	2	0.03	0.03

*Maximum of three on at a time.
**Only one used at a time.

CHART 201
ELECTRICAL UTILIZATION LOAD (Cont'd)

	Number Per Aircraft	Load Per Unit In Amps.	Load Per Aircraft In Amps.
CONTINUOUS LOAD-OPTIONAL EQUIPMENT			
Generator Control System (Cont'd)			
Generator Out Light	4	0.04	0.16
Paralleling Relay	2	0.09	0.18
Generator Control Relay	2	0.60	1.20
LH Wing Ice Light	1	2.14	2.14
Oxygen Panel Post Light	1	0.04	0.04
Copilot's Instrument Post Lights	18	0.04	0.72
Copilot's Clock Light	1	0.04	0.04
Copilot's Map Light	1	0.17	0.17
LH Heated Windshield System			
Inverter	1	29.00	29.00
Windshield Temperature Control Box	1	0.03	0.03
Windshield Temperature Control Relay	1	0.35	0.35
RH Heated Windshield System			
Inverter	1	29.00	29.00
Windshield Temperature Control Box	1	0.03	0.03
Windshield Temperature Control Relay	1	0.35	0.35
INTERMITTENT LOAD-STANDARD EQUIPMENT			
Lights			
Landing Lights	2	8.90	17.80
Taxi Light	1	9.00	9.00
Threshold Light	1	0.17	0.17
Nose Baggage Compartment Light	1	0.30	0.30
Fuel Boost Out Lights	4	0.04	0.16
Cowl Flap Motor	2	1.20	2.40
*Cigarette Lighter	5	7.50	7.50
Fuel Boost Pumps	2	14.00	28.00
Landing Gear Warning Horn	1	1.50	1.50
Landing Gear Warning Flasher	1	0.40	0.40
Landing Gear Dynamic Brake Relay	1	0.40	0.40

*Only one used at a time.

CHART 201
ELECTRICAL UTILIZATION LOAD (Cont'd)

	Number Per Aircraft	Load Per Unit In Amps.	Load Per Aircraft In Amps.
INTERMITTENT LOAD-STANDARD EQUIPMENT			
Landing Gear Motor	1	20.00	20.00
Wing Flap Motor	1	13.00	13.00
*Starter Relay	2	0.06	0.06
**Starter	2	275.00	275.00
Starting Vibrator	1	2.00	2.00
Stall Warning Horn	1	1.50	1.50
INTERMITTENT LOAD-OPTIONAL EQUIPMENT			
Electric Trim System (Elevator)			
Trim Motor	1	0.85	0.85
Trim Clutch	1	0.50	0.50
Magic Hand Switch	1	2.50	2.50
Surface Deice System			
Deice Relay	1	0.09	0.09
Time Delay Relay	1	0.17	0.17
Deice Valve	2	0.59	1.18
Control Valve	1	1.75	1.75
Nacelle Scoop Actuator	1	1.20	1.20

*Only one used at a time.

**Maximum stall load, only one used at a time.

"END"

CHAPTER 25

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DAT
25-EFFECTIVITY	1	Nov 20/8
25-CONTENTS	1	Nov 20/8
25-00-00	201	Apr 18/8
	202	Apr 18/8
25-60-00	1	Nov 20/8
	201	Nov 20/8
	202	Nov 20/8
	203	Nov 20/8
	204	Nov 20/8

"END"

CHAPTER 25-EQUIPMENT/FURNISHINGS

TABLE OF CONTENTS

"END"

GENERAL - MAINTENANCE PRACTICES

FLIGHT COMPARTMENT SEAT REMOVAL

a. Remove the three seat stops at the forward end of the three seat tracks.
b. Release the fore and aft seat adjustment lock.
c. Slide the seat forward and off the seat tracks.
d. Unhook the seat spring on the bottom of the seat.

FLIGHT COMPARTMENT SEAT INSTALLATION

a. Hook the seat spring on the bottom of the seat.
b. Position the seat and slide aft onto the seat track.
c. Secure the fore and aft seat adjustment lock.
d. Install the three seat stops at the forward end of the three seat tracks and secure.

FLIGHT COMPARTMENT SEAT BACK ADJUSTMENT

On airplanes P-4 and after, the pilot's seat back adjustments are controlled by a mechanical three-position stop. The adjustment selector is located at the base of the seat back, on the inboard side.

On airplanes P-4 thru P-510 and P-512 thru P-519, the copilot's seat back adjustments are controlled by a mechanical three-position stop or by a Roton lock for selected positioning. On airplanes P-511, P-520 and after, the copilot's seat back adjustments are controlled by a mechanical three-position stop or by a Hydrolok lock for selected positioning. The mechanical adjustment selectors are located at the base of the seat backs, on the inboard side. The Roton of Hydrolok adjustment lever is located on the inboard side of the seat. For information concerning Roton or Hydrolok servicing refer to ROTON LOCKS or HYDROLOK LOCKS in this chapter.

PASSENGER SEAT REMOVAL

a. Remove the seat stop from the middle seat track.
b. Release the fore and aft seat adjustment lock.
c. Slide the seat forward and off of the seat tracks.

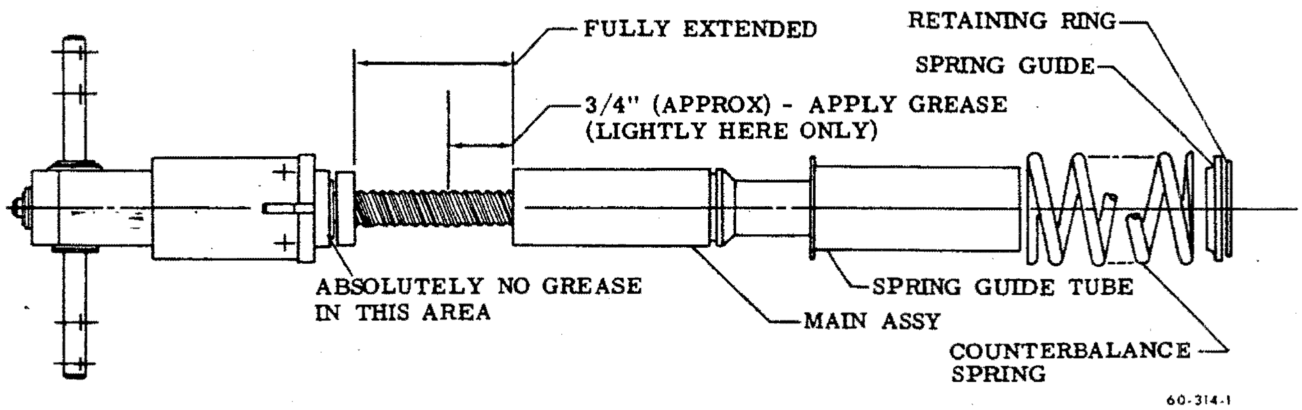
PASSENGER SEAT INSTALLATION

a. Position the seat and slide aft onto the seat tracks.
b. Secure the fore and aft seat adjustment lock.
c. Install the seat stop at the forward end of the middle seat track and secure.

PASSENGER SEAT BACK ADJUSTMENT

On airplanes P-4 thru P-510 and P-512 thru P-519, adjustment for the passenger seat backs is controlled by a mechanical three-position stop or by a Roton lock for selected positioning. On airplanes P-511, P-520 and after, adjustment for the passenger seat backs is controlled by a mechanical three-position stop or by a Hydrolok lock for selected positioning. The adjustment selector for the mechanical stop is located at the base of the seat back on the inboard side. The adjustment lever for the Roton or Hydrolok lock is located on the inboard side of the seat.

On airplanes P-511, P-520 and after, adjustment for the optional fifth and sixth passenger seat backs is controlled by



Roton Lock
Figure 201

two individually operated Hydrolok locks. The adjustment levers for the Hydrolok locks are located on the outboard armrests.

For information concerning Roton or Hydrolok servicing refer to ROTON LOCKS or HYDROLOK LOCKS in this chapter.

ROTON LOCKS
(Figure 201)

Usually Roton locks will need no service. If there is a grinding and binding in the lock as the seat reclines or the return action becomes jerky, a little grease properly applied as follows should improve the operation.

a. Use only grease (30, Chart 207, 91-00-00) on the threads as shown in Figure 201. Too much grease or grease in the wrong place can cause improper operation.

b. Compress the spring guide and counter-balance spring approximately one inch.

c. Remove the retaining ring.

d. Relax pressure on the spring guide and counter-balance spring slowly until the spring is fully extended.

e. Remove the lock from the fixture and remove the spring guide, counter-balance spring, and spring guide tube.

f. Apply a small quantity of grease to the completely extended thrust screw (see Figure 201).

g. Reassemble the lock.

NOTE

A new lock will need to be purchased if service other than lubrication is required.

HYDROLOK LOCKS

Hydrolok locks will usually need no service, but if service is required return the unit to the manufacturer.

"END"

EMERGENCY - DESCRIPTION AND OPERATION

EMERGENCY LOCATOR TRANSMITTER

Airplane serials P-166, P-183 thru P-185, P-187 thru P-244 and P-246 and after are equipped with an emergency locator transmitter (ELT) to assist in the tracking and recovery of any airplane and crew in the event of a crash, or if an emergency landing is necessitated. Airplane serials P-166, P-183 thru P-185, P-187 thru P-244 and P-246 thru P-536 are equipped with Collins/Communications Corporation ELT units. Narco ELT units are installed on airplane serials P-537 and after and earlier airplanes equipped with Kit No. 101-3046-1.

The ELT is mounted in the aft fuselage on the RH side at approximately F.S. 290.00. An antenna for the ELT is mounted on top of the fuselage under the vertical stabilizer at approximately F.S. 297.00. The output frequencies of the ELT are 121.5 and 243.0 MHz simultaneously. Range is approximately line of sight. The ARM-OFF-ON switch located on the transmitter controls the operation of the set. The ON position turns the set on for testing and the ARM position actuates the set to operate automatically upon impact. A reset switch, located on the forward end of the transmitter, resets the transmitter in the event the impact switch is accidentally triggered. Airplane serials P-166, P-183 thru P-185, P-187 thru P-244 and P-246 thru P-536 equipped with Kit No. 101-3039-1 have a remote switch located on the RH side of the rear fuselage. The remote switch, placarded REARM-ARM-XMIT, is accessible thru an access hole with a spring-loaded door located adjacent to the transmitter. The XMIT position turns the set on for testing and the ARM position actuates the set to operate automatically upon impact. The REARM position resets the transmitter in the event the impact switch is accidently triggered. Airplane serials P-537 and after, and earlier airplanes equipped with Kit No. 101-3046-1 have a remote switch installed on the RH side of the rear fuselage. The remote switch, placarded ARM-XMIT, is accessible thru an access hole with a spring-loaded door located adjacent to the transmitter. An optional installation is available for the remote switch so that it may be installed in the instrument panel. The remote switch is a momentary switch that enables manual activation of the ELT for testing purposes while the unit is installed in the airplane.

"END"

EMERGENCY - MAINTENANCE PRACTICES

EMERGENCY LOCATOR TRANSMITTER MAINTENANCE

Maintenance on the ELT is normally limited to replacing the battery. The following is a list of the various conditions which warrant battery replacement.

a. Visual inspection shows signs of leakage, corrosion, or unsecured leads.

b. Elapsed replacement date noted on the battery case (this date represents 50% of the useful life of the battery).

NOTE

The useful life of the battery is the length of time which the battery may be stored without losing its ability to continuously operate the ELT for 48 hours.

c. After any emergency use.

d. After one cumulative hour of use.

e. After operation of unknown duration.

f. If the transmitter is stored in an area where the temperature is normally above 38°C (100°F), battery life will be shortened.

CAUTION

Avoid storage of batteries at temperatures in excess of 55°C (130°F).

The information on battery life and replacement is included in the data furnished with each ELT, and is usually placarded on the battery.

NOTE

Replacement batteries should be obtained only from ELT and airplane manufacturers or other acceptable suppliers, since the condition and useful life of over-the-counter batteries, such as those sold for flashlights, portable radios, etc., are usually unknown.

CAUTION

The ELT switch should not be turned ON unless the ELT is connected to its associated antenna or a 50-ohm dummy load.

COLLINS/COMMUNICATIONS COMPONENTS CORPORATION BATTERY REPLACEMENT

NOTE

The Narco ELT may be supplied by Kit No. 101-3046 for airplanes originally equipped with units produced by Collins/Communications Components Corporation.

a. Place the RM-OFF-ON switch on the ELT in the OFF position.

b. Disconnect the antenna cable and the remote switch wiring, if installed, and remove the ELT from the airplane.

c. Remove the screws which hold the mounting base on the transmitter and remove the base.

d. Remove the old battery and disconnect the electrical connector. Discard the old battery.

WARNING

DO NOT discard the battery in fire.

NOTE

Inspect for and properly treat any corrosion in the area when the battery is replaced.

e. Connect a fresh battery and install it in the compartment.

f. Replace the base and screws.

g. Install the transmitter in the airplane and attach the antenna cable and remote switch wiring, if installed.

h. The new replacement date should be marked on the ELT in a visible area. This will aid in future inspections of the ELT. This date is 50% of the useful life of the battery as defined by the battery manufacturer.

NARCO BATTERY REPLACEMENT

a. Place the ARM-OFF-ON switch on the ELT in the OFF position.

b. Disconnect the antenna cable from the ELT. Disconnect the remote switch wiring, if installed, from the terminals on the ELT.

c. Unlatch the mounting strap and remove the ELT from the airplane.

d. Extend the portable antenna.

CAUTION

To avoid damage to the antenna or the plastic tab on the upper end, care must be exercised in extending the portable antena and handling the control head.

e. Remove the four screws attaching the control head to the battery casing and slide the control head and the battery case apart. The battery connection leads are approximately 3 inches long.

NOTE

Do not remove the sealant on the inside lip of the battery pack or a water tight seal will not be made when the ELT unit is reassembled.

f. Disconnect the battery by unsnapping the battery terminals from the bottom of the transmitter PC board. Discard the old battery.

NOTE

Inspect for and properly treat any corrosion in the area when the battery is replaced.

WARNING

DO NOT discard the battery in fire.

g. Connect the terminals of the ne battery to the bottom of the transmitte PC board.

h. Using a stick, apply a bead o sealant (supplied with each battery pack around the area of the control head whic is joined with the battery case whe reassembled.

NOTE

This sealant provides a watertight seal when the unit is assembled.

i. Insert the control head sectio into the battery case, being careful no to pinch the wires, and install the fou attaching screws. Wipe any excess sealan from the outside of the unit.

NOTE

If the four screw holes do not line up, rotate the battery case 180° and reinsert.

j. Stow the portable antenna.

CAUTION

Exercise extreme care in order to avoid damage to the antenna or the plastic tab on the upper end.

k. Install the transmitter in th airplane and secure the mounting strap.

l. Connect the fixed antenna cabl to the ELT. Ensure that the (plastic contact separator is inserted between th portable antenna contact and the portabl antenna.

NOTE

Without the contact separator in place, a very weak signal may be transmitted. This signal may be strong enough for a functional test but too weak for emergency use.

m. Connect the remote switch wiring, if installed, to the terminals on the ELT.

n. Press the RESET button and place the ARM-OFF-ON switch on the ELT in the ARM position.

o. The new replacement date should be marked on the ELT in a visible area. This will aid in future inspections of the ELT. This date is 50% of the useful life of the battery as defined by the battery manufacturer.

TESTING EMERGENCY LOCATOR TRANSMITTER.

Generally, tests will be performed following maintenance or repair of ELTs, other than battery replacement, to determine their operational capability. Testing the ELT, if improperly done, could trigger false alerts and create frequency jamming and may interfere with the reception of a bonafide emergency transmission. Federal Communications Comission regulations require that this testing be performed in a screened or shielded test room, or in a test enclosure that will hold the self contained ELT unit with the antenna fully extended.

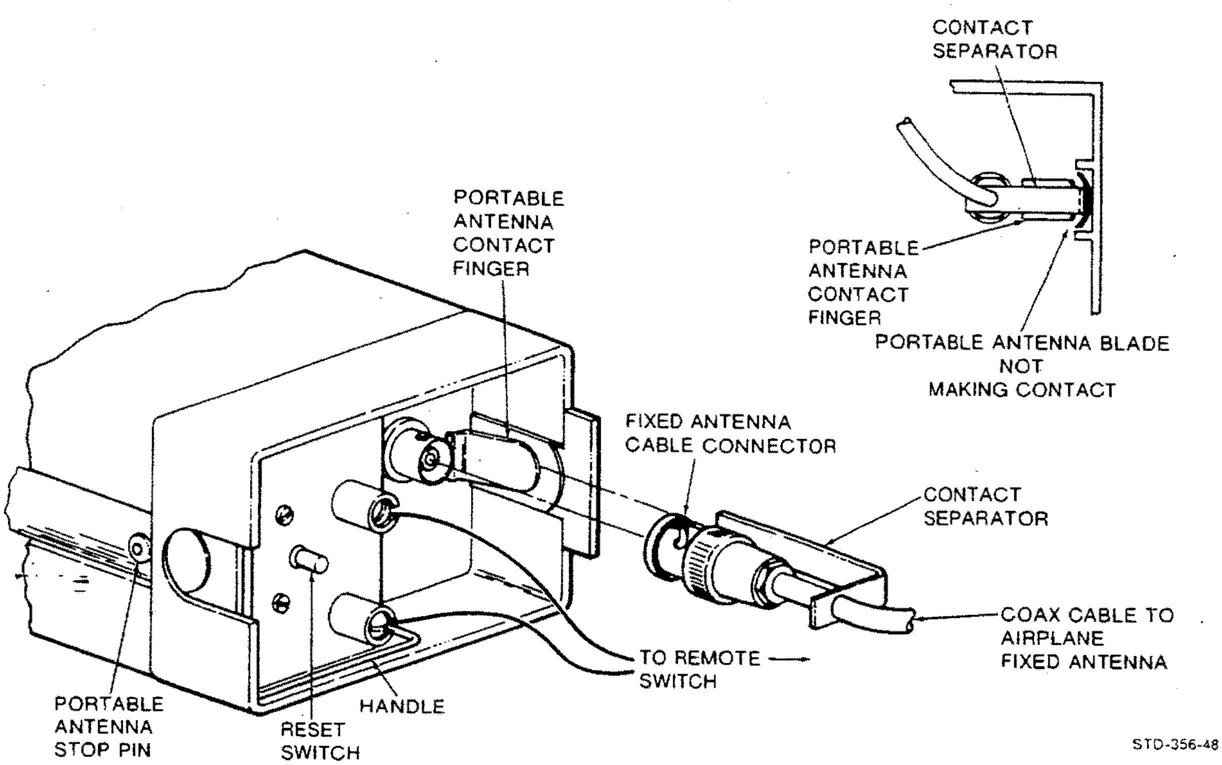
CAUTION

The ELT switch should not be turned ON unless the ELT is connected to its associated antenna or a 50-ohm dummy load.

Operational testing of installed ELTs may be accomplished as follows:

NOTE

Tests should not be longer than three audio sweeps. One audio sweep may be defined as amplitude modulating the carrier with an audio frequency sweeping downward over a range of not less than 700



Narco ELT
Figure 201

Hz, within the range 1600 to 300 Hz, and a sweep repetition rate between two and four Hz. Tests should be conducted only in the first five minutes of any hour. If the operational tests must be made at a time not included within the first five minutes after the hour, the tests should be coordinated with the nearest FAA tower or flight service station.

a. Turn COMM-1 ON and tune the transceiver to 121.5 MHz.

b. Turn the COMM-1 audio switch to the SPEAKER position and place the volume control in the center of its range.

c. Turn the ELT ARM-OFF-ON (TEST AUTO XMIT, XMIT ARM) switch to ON and monitor the ELT signal.

NOTE

If there is no audible signal, the battery is probably disconnected or dead, assuming that the VHF transceiver is operational.

d. Place the ARM-OFF-ON (TEST A[illegible] XMIT, XMIT ARM) switch on the ELT to [illegible] OFF position. The audio signal sho[illegible] disappear completely.

e. Place the switch in the ARM po[illegible]tion. There should be no audio sig[illegible] present.

NOTE

If a signal is heard, the impact switch has probably been activated and should be reset.

f. Firmly press the reset switch [illegible] the front of the ELT and listen to ens[illegible] the audio signal disappears from COMM-[illegible]

"END"

CHAPTER 27
RECORD OF TEMPORARY REVISIONS

REVISION NUMBER	DATE INSERTED	DATE REMOVED	REASON REMOVED	PAGE NUMBER
27-1	Dec 11/92	Nov 15/93	Temporary Revision 27-2	27-50-00 Page 203
27-2	Nov 15/93			27-50-00 Page 203

NOTE: Insert this Record of Temporary Revisions after the Chapter 27 divider tab.

CHAPTER 27

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
27-EFFECTIVITY	1	Sep 20/85
27-CONTENTS	1	Sep 20/85
	2	Sep 20/85
27-00-00	1	Nov 2/73
	201	Nov 2/73
	202	Nov 2/73
27-10-00	201	Nov 2/73
	202	Nov 2/73
	203	Sep 14/79
	204	Sep 14/79
	205	Sep 14/79
27-20-00	201	Nov 2/73
	202	Nov 2/73
	203	Nov 2/73
	204	Sep 14/79
	205	Sep 14/79
27-30-00	201	Sep 20/85
	202	May 30/75
	203	Sep 20/85
	204	Sep 20/85
	204A	Sep 20/85
	205	Sep 14/79
	206	Sep 14/79
	207	Sep 14/79
27-50-00	1	Nov 2/73
	201	Nov 2/73
	202	Nov 2/73
	203	Nov 2/73
27-60-00	1	Nov 2/73
	101	Nov 2/73
	201	Nov 2/73
27-70-00	201	Nov 2/73

"END"

CHAPTER 27 - FLIGHT CONTROLS

TABLE OF CONTENTS

CHAPTER 27 - FLIGHT CONTROLS

TABLE OF CONTENTS (Cont'd)

"END"

GENERAL - DESCRIPTION AND OPERATION

The flight controls, with the exception of the flaps, are conventional cable operated surfaces requiring no power assistance for normal control by the pilot or copilot. The aileron, elevator, and rudder have cable operated flight adjustable trim tabs. The flaps have electrically powered actuators controlled by a switch on the subpanel.

Positive stops on the control surface bell cranks limit their travel, while travel stops secured on the tab cables limit the trim tab movement.

Since the control cables can be disconnected at the turnbuckles, each cable has one right hand and one left hand threaded cable end. Cable routing off the pedestal, control column and actuator drums is shown in Figure 201 of 27-10-00, 27-20-00, and 27-30-00.

EFFECT OF TEMPERATURE UPON CABLE TENSION

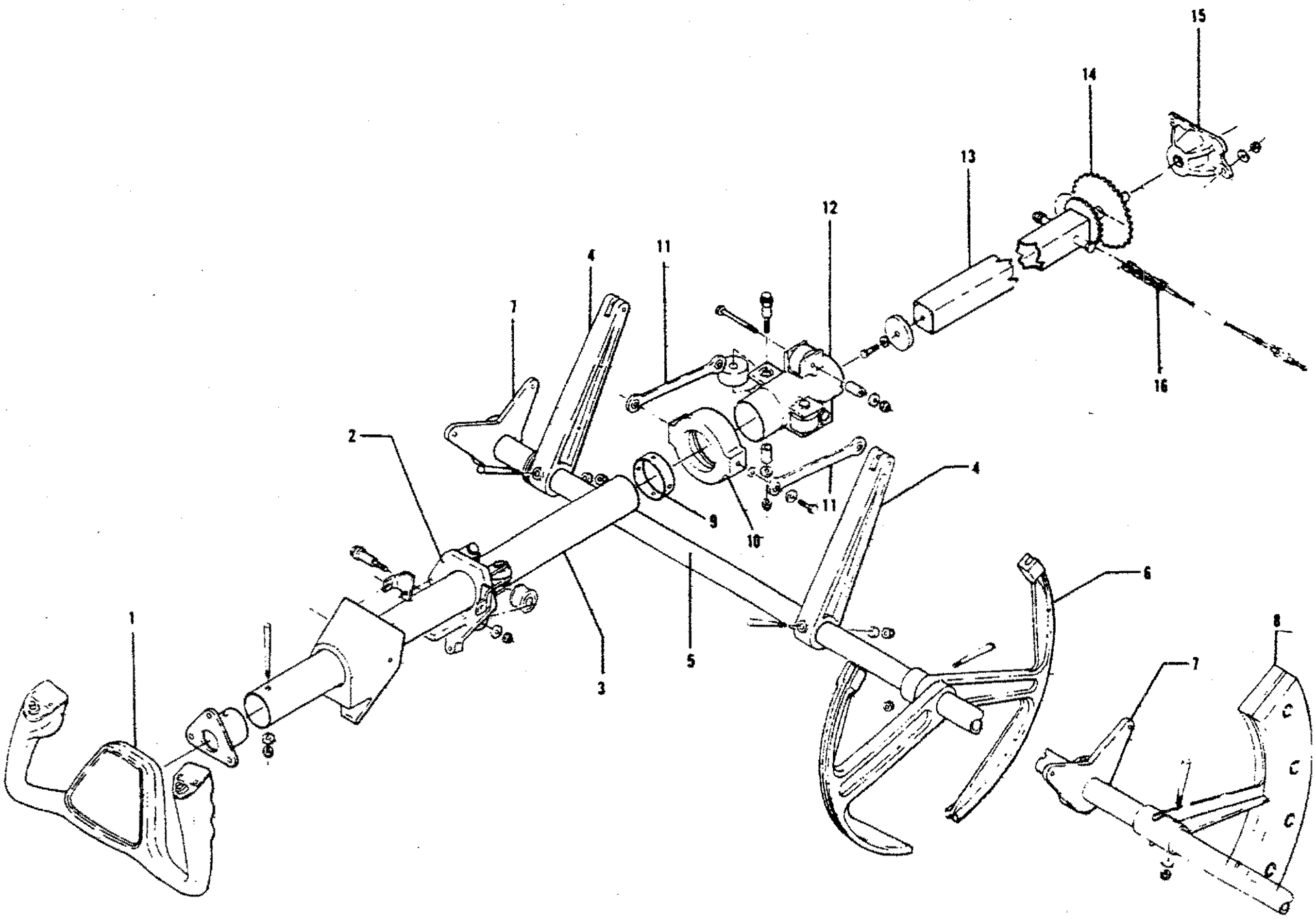
Graphs specifying the correct maximum and minimum cable tension permissible for the various controls appear on the individual rigging control system illustrations. The graphs provide rigging limits at temperatures varying from 30° to 110°F. The horizontal scale on the graphs designates the temperature in degrees fahrenheit at which the control cables may be rigged, and the vertical scale designates the correct tension in pounds for each temperature reading.

"END"

GENERAL - MAINTENANCE PRACTICES

CONTROL COLUMN
(Figure 201)

Refer to the applicable rigging procedures for details regarding chain and cable tension, control wheel movement and force, and system friction. Any time the control column has been removed and disassembled, the following



1.	Wheel	9.	Collar
2.	Collar Assembly	10.	Collar Assembly
3.	Column Torque Tube	11.	Elevator Push Rod
4.	Elevator Torque Arm	12.	Connector
5.	Elevator Torque Tube	13.	Inner Column
6.	Elevator Bell Crank	14.	Sprocket
7.	Elevator Torque Tube Support	15.	Bearing Support
8.	Bob Weight Assembly	16.	Chain

Control Column
Figure 201

precautions should be observed:

a. When the taper pin just forward of the control wheel is to be installed, use a light weight rawhide or nylon mallet to set the pin. The small end of the tapered shank should be flush with, or extend no more than .06 inch over the surface.

CAUTION

The taper pin may crack the control column torque tube if driven excessively.

b. The procedure noted above shall apply to the taper pins used to install the torque arms and the bob weight assembly.

c. When installing the torque tube guide, apply thread locking compound (36, Chart 207, 91-00-00) to bolt threads prior to installation.

CONTROL COLUMN BUS CABLE REMOVAL

a. Disconnect the aileron cables from the control column at the turnbuckles.

b. Paint one tooth of each of the control column sprockets and its corresponding chain link to ensure proper alignment of the control wheels at installation.

c. Loosen the cable turnbuckle in the center of the control column horizontal cross member. Remove safety wire from the chains and sprockets. Remove the cable and chain assembly.

CONTROL COLUMN BUS CABLE INSTALLATION

a. Install the control column bus cable and chain assembly on the cross member of the control column with the painted links of the chains engaging the corresponding painted sprocket teeth.

b. Rig the control column bus cable and safety wire the chain to the sprockets as shown in Figure 202.

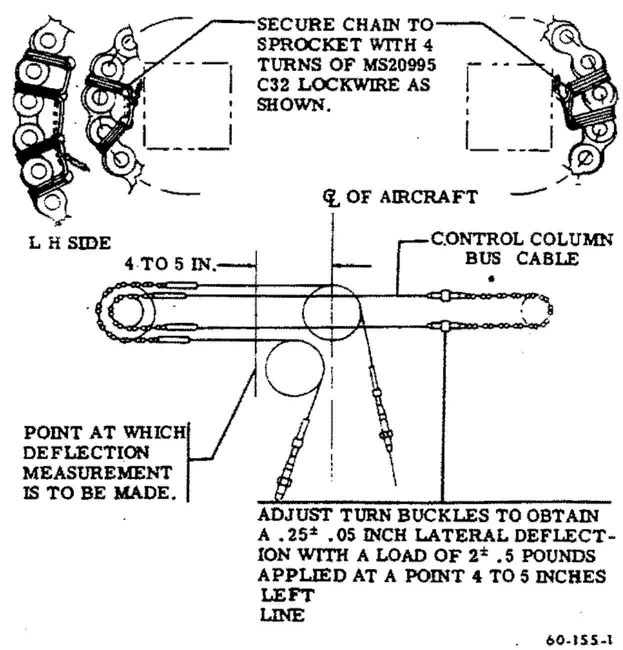
c. Rig the aileron control cable. (Refer to 27-10-00).

CONTROL COLUMN BUS CABLE RIGGING
(Figure 202)

Rigging of the control column bus cable can be accomplished by adjusting the bus cable turnbuckles to obtain a .25 ± .05 inch deflection with a load of 2 ± .5 pounds applied at a right angle, 4 to 5 inches to the left of the aircraft center line as shown in Figure 202.

NOTE

When final adjustment of the bus cable is established, the pilot and copilot control wheels should be in neutral position.



Control Column Bus Cable Adjustment
Figure 202

"END"

left side of the pedestal.

c. Remove the forward left passenger seat and the floorboard.

d. Remove the necessary access plates to gain access to the trim tab cables, the actuator, and the cable pulley brackets.

e. Remove the cable retaining pins at the pulley brackets.

f. Disconnect the tab cables at the turnbuckles in the left wing. Identify and connect lead lines on the cable ends.

g. Remove the cable stops and the pressure seals.

h. Remove the outboard cable from the actuator sprocket. Remove the cable through the actuator access opening.

i. Remove one chain link at the sprocket on the pedestal. Remove the cable through the pilot's compartment.

AILERON TRIM TAB CABLE INSTALLATION

a. Position the chain of the forward tab cable around the pedestal sprocket and install the chain link.

b. Route the cable ends aft in the fuselage and outboard into the left wing.

c. Position the chain of the outboard cable around the actuator sprocket and route the cable ends inboard.

d. Install the cable stops and connect the cables at the turnbuckles in the wing.

e. Install all cable retaining pins in the pulley brackets.

f. Using PD680 solvent (15, Chart 207, 91-00-00), clean the cables for the length of travel through the pressure seals. Lubricate to one inch beyond the cleaned area with MIL-G-23827 grease (11, Chart 207, 91-00-00).

g. Fill the pressure seals with MIL-G-23827 grease (11, Chart 207, 91-00-00). Install the seals.

h. Rig the aileron trim tab control system.

i. Install all access plates in the left wing.

j. Install the floorboard and the left forward passenger seat.

k. Install the floorboard and the pilot's seat.

l. Install the upholstery panel on the left side of the pedestal.

AILERON TRIM TAB RIGGING (Figure 201)

a. Place cockpit aileron trim tab control in neutral position.

b. Place aileron in neutral position and connect trim tab to tab actuator.

c. By turning the sprocket on the actuator, adjust the trim tab to both extremes of travel; measure both settings and return the tab to the mid-point of the two extremes of travel. This will place the actuator in the neutral position.

d. If the trim tab is not in the neutral position upon completion of step "c", adjust push rod to place tab in neutral position.

e. Center the chain on the sprocket and tighten the cable. Rig cable tension and adjust travel as noted on the Aileron Tab Rigging Illustration (Figure 201).

f. Check trim tab travel, adjust cable stops and safety turnbuckles.

NOTE

After rigging the aileron and aileron tab control system, check for correct movement of the control surfaces with respect to the movement of the controls.

Since the aileron tab is an anti-servo tab, every time the aileron moves up the tab should move up.

AILERON TRIM TAB ACTUATOR REMOVAL

a. Remove the access plates at the actuator and tab cable turnbuckles.

b. Disconnect the outboard cable at the turnbuckles in the wing.

c. Remove the outboard cable from the actuator sprocket.

d. Disconnect the actuator from the trim tab linkage.

e. Remove the bolts attaching the actuator to the wing structure. Remove the actuator.

AILERON TRIM TAB ACTUATOR INSTALLATION

a. Position the actuator against the wing structure and install the attaching bolts.

b. Connect the actuator to the tab linkage.

c. Install the outboard cable on the actuator sprocket.

d. Connect the cables at the turnbuckles in the wing.

e. Rig the aileron trim tab control system.

f. Install the access plates at the actuator and the tab cable turnbuckles.

CHECKING AILERON TAB FREE PLAY

Visually inspect the left aileron tab for damage, security of hinge attach points, and for tightness of the actuating system. Inconsistancies should be corrected prior to checking the free play of the tab. The aileron tab free play check should be performed at least once a year to ensure that the trim tab free play falls within the prescribed limits.

A check fixture (P/N 45-135030-9/810) or the equivalent as shown in Figure 202, a dial indicator, and a push-pull scale for applying accurate loading to the tab is required for making the inspection for free play of the tab.

a. Securely lock the control surfaces to prevent movement of the ailerons. Set the aileron tab in the neutral position.

b. Using shot bags, affix the dial indicator check fixture so that the dial indicator point is 2.30 inches aft of the tab hinge line and on the outboard edge of the aileron tab.

c. Apply a small piece of masking tape (for paint protection) 4.00 inches aft of the tab hinge line and along the centerline of the tab actuator. This will be the point of pressure against the tab by the push-pull scale.

d. Apply another piece of masking tape in the corresponding position on the bottom surface of the tab for the same purpose.

e. Zero the dial indicator at no load initially. Do not reset during the checking procedure.

f. With the push-pull scale at the point of masking tape, apply a full 3-pound downward load. Record the dial reading as "A".

g. Release half the load until a 1.5-pound downward load is obtained. Record the dial reading as "B".

h. Apply a full 3-pound upward load at the masking tape on the bottom surface. Record the dial reading as "C".

i. Release half the load until a 1.5-pound upward load is obtained. Record the dial reading as "D".

j. Enter the recorded values on a copy of Chart 201 and proceed as follows:

1. Multiply "B" by 2 and record as "2B".
2. Subtract "A" from "2B" and record as "X".
3. Multiply "D" by 2 and record as "2D".
4. Subtract "C" from "2D" and record as "Y".

NOTE

The results of "X" and "Y" can be negative numbers.

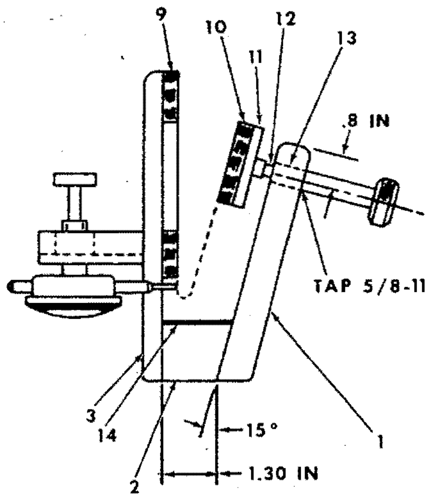
5. Add "X" and "Y" and record as "E".

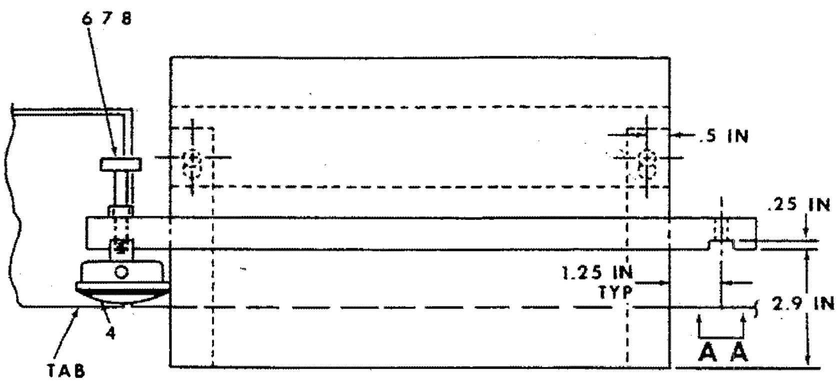
CHART 201
AILERON TAB FREE PLAY LIMITS

1.5-POUND READING	*3-POUND READING*	
B ________		
2B ________	−A ________	=X ________
D ________		
2D ________	−C ________	=Y ________
X ________	+Y ________	=E ________

(E = 0.032 inch maximum)

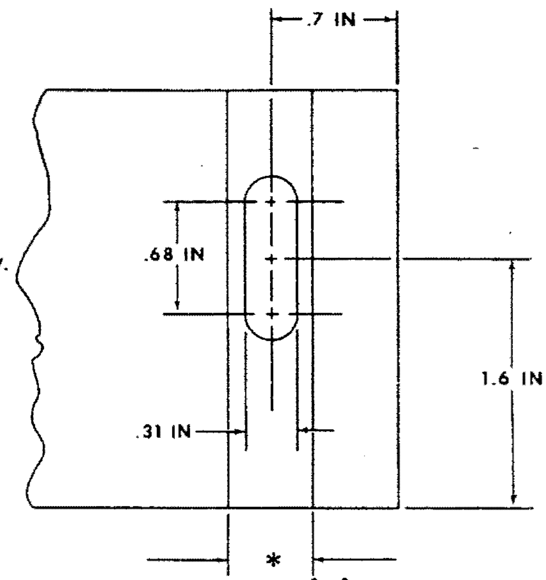
k. If the aileron trim tab free play exceeds the 0.032 inch maximum noted above, inspect all components of the tab actuation system to determine the cause. All worn parts should be replaced.





ITEM NO.	QUANT.	DESCRIPTION
1	2	3/4 x 1 x 6 aluminum or equiv.
2	2	1 x 1 3/8 x 1 3/4 aluminum or equiv.
3	1	1/2 x 7 1/2 x 10 aluminum or equiv.
4	1	C81Q Indicator**
5	1	3/4 x 2 1/2 x 14 aluminum or equiv.
6	1	1/4 Dia. x 2 corrosion res. stl.
7	1	1/4 Dia. x 1 corrosion res. stl.
8	1	1/4-28 nut
9	1	3/8 x 5 x 10 rubber
10	1	3/8 x 2 x 10 rubber
11	1	1/4 x 2 x 10 corrosion res. stl.
12	2	1/2 x 13 x 3 VLIER Torque screw
13	2	KN813 Keensert or tap 1/2 - 13
14	2	1/8 x 1 x 3/4 rubber

**P/N of Federal Products Corp., Providence, R.I.



SECTION A A

* THIS GROOVE TO BE A SNUG FIT TO THE SCREW BRACKET ON THE DIAL INDICATOR

100-135-8

(P/N 45-135030-9/810) Check Fixture for Tab Deflection
Figure 202

"END"

RH horizontal stabilizer, and the access panel in the aft floorboard.

RUDDER TRIM TAB CABLE REMOVAL
(Figure 201)

a. Remove the tail cone, the access plate beneath the RH horizontal stabilizer, and the access plate at the trim tab actuator.

b. Remove the pilot's seat and the left floorboard.

c. Remove both upholstery panels on the left side of the pedestal.

d. Remove the left passenger seat, the floorboard between the main and rear spar, and the access panel in the floorboard aft of the rear spar.

e. Remove the cable retaining pins from the pulley brackets and the pressure seals from the rear pressure bulkhead.

f. Disconnect the trim tab cables, in the aft fuselage, at the turnbuckles and connect lead lines to the forward cables. Identify the lead line for tab left and tab right movement to ensure proper cable rerouting.

g. Remove the taper pin from the forward universal and remove the attaching shaft and cable reel. Note and record the number of cable revolutions on the reel.

h. Remove the forward trim tab cable through the pilot's compartment.

i. Remove the tab cable stops and disconnect the chain and cable assembly at the trim tab actuator. Remove the aft cable chain and cable assembly.

RUDDER TRIM TAB CABLE INSTALLATION
(Figure 201)

a. With the rudder tab in neutral, position the aft chain and cable assembly on the trim tab actuator sprocket so that the ends of the chain are equi-distant at the sprocket centerline within ± .20 inch.

b.. Route the aft chain and cable assembly forward in the aft fuselage.

c. Place the rudder trim tab control wheel in neutral position and wrap the forward cable around the reel the same number of revolutions noted during removal, maintaining the cable ends equi-distant.

d. Install the attaching shaft, washer and reel; align the shaft with the forward universal and install the taper pin.

NOTE

> When the trim tab control cable is disconnected at the pedestal, the tab wheel shall turn smoothly with very little resistance. Bearings not previously lubricated may be lubricated with MIL-L-6086 lubricating oil (7, Chart 207, 91-00-00). Lubricate shafts and thrust surfaces in all trim tab systems with MIL-G-23827 grease (11, Chart 207, 91-00-00) for friction reduction.

e. Route the forward cable end aft and install all cable retaining pins in the pulley brackets.

f. Using PD680 solvent (15, Chart 207, 91-00-00), clean the cables for the length of travel through the pressure seals. Lubricate to one inch beyond the cleaned area with MIL-G-23827 grease (11, chart 207, 91-00-00).

g. Fill the pressure seals with MIL-G-23827 grease (11, Chart 207, 91-00-00). Install the seals.

h. Install the cable stops and connect the cables to the turnbuckles in the aft fuselage. Rig the rudder trim tab control system.

i. Install the access panel in the floorboard aft of the rear spar, the floorboard between the main and rear spar, and the left passenger seat.

j. Install both upholstery panels on the left side of the pedestal.

k. Install the left floorboard and the pilot's seat.

l. Install the tail cone, the access plate beneath the RH horizontal stabilizer and the access plate at the trim tab actuator.

RUDDER TRIM TAB RIGGING

a. Disconnect the tab from its actuator.

b. Position the rudder in neutral and set the tab indicator at zero degrees.

c. Rig the tab cables to the proper tension as determined by the Temperature-Cable Tension Chart. Safety wire the turnbuckles.

d. Position the tab actuator screw at the midpoint of its travel.

e. Adjust the actuator linkage until the tab is in the neutral position with the chain centered on the actuator sprocket and connect the tab to the actuator.

f. Adjust the cable stops until the rudder tab has a travel of 19 to 21 degrees to both the left and right.

g. Torque the cable stops to 40 to 60 inch-pounds and safety.

h. Check the tab control and tab surface for correct movement as indicated by the tab indicator. When the tab control is moved to the left, the tab should move to the right.

i. Check the rudder trim tab control system for friction at the tab control wheel shaft. At room temperature, the maximum allowable torque limit is 12 inch-pounds.

RUDDER TRIM TAB ACTUATOR REMOVAL

a. Remove the access plate at the trim tab actuator.

b. Remove the tail cone and the access plate beneath the RH horizontal stabilizer.

c. Remove the access panel in the floorboard aft of the rear spar.

d. Disconnect the tab control cables at the turnbuckles in the aft fuselage.

e. Disconnect the tab actuator at the tab.

f. Remove the aft chain and cable assembly from the actuator sprocket.

g. Remove the bolt attaching the actuator to the actuator hinge. Remove the actuator.

RUDDER TRIM TAB ACTUATOR INSTALLATION

a. Position the tab actuator on the actuator hinge and install the attaching bolt.

b. Connect the actuator at the tab.

c. With the rudder tab in neutral, position the aft chain and cable assembly on the actuator sprocket so that the ends of the chain are equi-distant at the sprocket centerline within ± .20 inch.

d. Connect the tab control cables to the turnbuckles in the aft fuselage.

e. Rig the rudder tab control system.

f. Install the access panel in the floor board aft of the rear spar.

g. Install the tail cone and the access plate beneath the RH horizontal stabilizer.

h. Install the access plate at the trim tab actuator.

CHECKING RUDDER TAB FREE PLAY

Visually inspect the rudder tab for damage, security of hinge attach points, and for tightness of the actuating system. Inconsistancies should be corrected prior to checking the free play of the tab. The rudder tab free play check should be performed at least once a year to ensure that the trim tab free play falls within the prescribed limits.

A check fixture (P/N 45-135030-9/810) or the equivalent as shown in Figure 202, a dial indicator, and a push-pull scale for applying accurate loading to the tab is required for making the inspection for free play of the tab.

a. Securely lock the control surface to prevent movement of the rudder. Set the rudder tab in the neutral position.

b. Tape the dial indicator check fixture to the rudder so that the dial indicator point is positioned 8.70 inches aft of the tab hinge line and at the top edge of the tab.

c. Apply a small piece of masking tape (for paint protection) 9.0 inches aft of the tab hinge line and along the centerline of the tab actuator. This will be the point of pressure against the tab by the push-pull scale.

d. Apply another piece of masking tape in the corresponding position on the opposite side for the same purpose.

e. Zero the dial indicator at no load initially. Do not reset during the checking procedure.

f. With the push-pull scale at the point of masking tape, apply a full 3-pound load to the right. Record the dial reading as "A".

g. Release half the load until a 1.5-pound load is obtained. Record the dial reading as "B".

h. Apply a full 3-pound load at the masking tape on the opposite surface. Record the dial reading as "C".

i. Release half the load until a 1.5-pound load is obtained. Record the dial reading as "D".

j. Enter the recorded values on a copy of Chart 201 and proceed as follows:

1. Multiply "B" by 2 and record as "2B".
2. Subtract "A" from "2B" and record as "X".
3. Multiply "D" by 2 and record as "2D".
4. Subtract "C" from "2D" and record as "Y".

NOTE

The results of "X" and "Y" can be negative numbers.

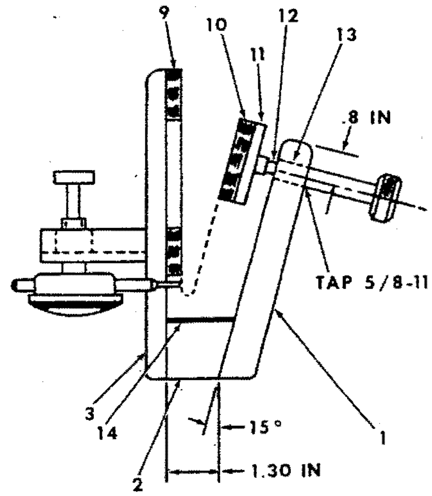
5. Add "X" and "Y" and record as "E".

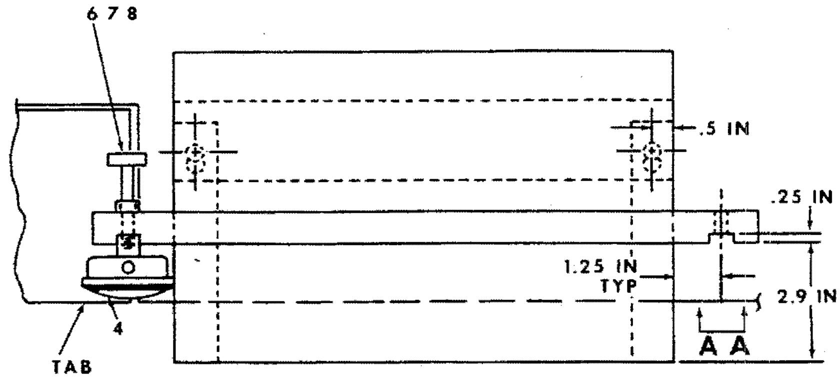
CHART 201
RUDDER TAB FREE PLAY LIMITS

1.5 POUND READING	*3-POUND READING*	
B ________		
2B ________	−A ________	=X ________
D ________		
2D ________	−C ________	=Y ________
X ________	+Y ________	=E ________

(E = 0.061 inch maximum)

k. If the rudder trim tab free play exceeds the 0.061 inch maximum noted above, inspect all components of the tab actuation system to determine the cause. All worn parts should be replaced.





ITEM NO.	QUANT.	DESCRIPTION
1	2	3/4 x 1 x 6 aluminum or equiv.
2	2	1 x 1 3/8 x 1 3/4 aluminum or equiv.
3	1	1/2 x 7 1/2 x 10 aluminum or equiv.
4	1	C81Q Indicator**
5	1	3/4 x 2 1/2 x 14 aluminum or equiv.
6	1	1/4 Dia. x 2 corrosion res. stl.
7	1	1/4 Dia. x 1 corrosion res. stl.
8	1	1/4-28 nut
9	1	3/8 x 5 x 10 rubber
10	1	3/8 x 2 x 10 rubber
11	1	1/4 x 2 x 10 corrosion res. stl.
12	2	1/2 x 13 x 3 VLIER Torque screw
13	2	KN813 Keensert or tap 1/2 - 13
14	2	1/8 x 1 x 3/4 rubber

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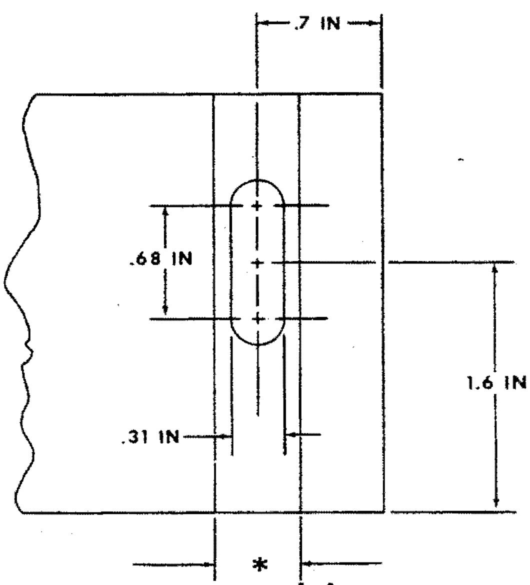


SECTION A A

* THIS GROOVE TO BE A SNUG FIT TO THE SCREW BRACKET ON THE DIAL INDICATOR

100-135-8

(P/N 45-135030-9/810) Check Fixture for Tab Deflection
Figure 202

"END"

NOTE

To position the elevator in neutral on airplane serials P-438 and after, fabricate a tool from 5/16 inch diameter steel rod as shown in Figure 201A.

a. Remove the tail cone and the access plate on the side of the fuselage beneath the RH horizontal stabilizer.

b. Position the aft elevator bell crank in neutral by inserting a 3/16 inch diameter rig pin through the bell crank and adjacent structure.

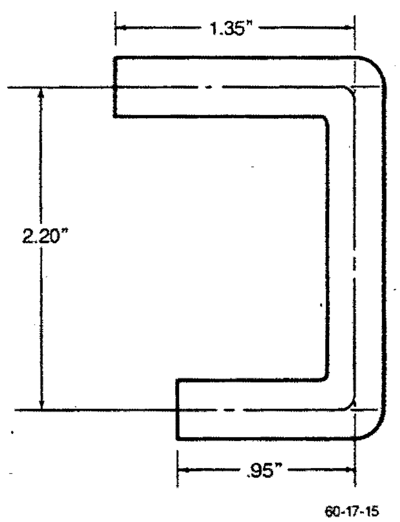
c. Adjust the elevator push rods to place the elevator in neutral.

NOTE

After the push rods are adjusted, the threads on the rod ends must be visible in the inspection holes at each end of the push rods.

d. Remove the rig pin from the aft elevator bell crank and adjust the elevator travel stops to obtain 17° ± 1° up travel and 15° ± 1° down travel.

FABRICATE FROM 5/16-INCH DIAMETER STEEL ROD



Elevator Neutral Rigging Tool
(P-438 and after)
Figure 201A

e. On airplane serials prior to P-438, insert a 1/4 inch diameter rig pin in the control lock pin hole in the control column. Insert a 3/16 inch diameter rig pin in the aft elevator bell crank and adjacent structure.

f. To set the elevator controls in neutral on airplane serials P-438 and after, insert the short end of the fabricated tool (see Figure 201A) in the control column hanger. Move the control aft and insert the other end of the tool into the control shaft and torque tube. Insert a 3/16 inch diameter rig pin in the aft elevator bell crank and adjacent structure.

g. With the rig pins and elevator down springs installed, rig the elevator cable tension as noted on the Elevator Rigging Illustration, Figure 201.

h. Remove the rig pins, securely tighten all lock nuts and safety wire the turnbuckles.

NOTE

With the system fully installed (including the autopilot when installed) measure the force required to move the control column from the full forward position through neutral with a hand force gage. This force should measure between 32 and 36 pounds. The force required to restrain the control column when passing through neutral from a position not more than one inch aft of neutral should measure between 16 and 20 pounds when the system is properly rigged.

NOTE

After rigging the elevator and elevator tab control system, check for correct movement of the control surfaces with respect to the movement of the controls. When the elevator trim tab control wheel is moved toward the NOSE DOWN position, the elevator tab should move UP.

i. Install the tail cone and the access plate on the side of the fuselage beneath the RH horizontal stabilizer.

ELEVATOR TRIM TAB CABLE REMOVAL (Figure 201)

a. Remove the tail cone, the access plate beneath the RH horizontal stabilizer, and the access plate at the trim tab actuator.

b. Remove the pilot's seat and the left floorboard.

c. Remove both upholstery panels on the left side of the pedestal.

d. Remove the left passenger seat, the floorboard between the main and rear spar, and the access panel in the floorboard aft of the rear spar.

e. Remove the cable retaining pins from the pulley brackets and the pressure seals from the rear pressure bulkhead.

f. Disconnect the trim tab cables, in the aft fuselage, at the turnbuckles. Identify the cable for tab up movement and connect lead lines to the cables.

g. Remove the pressure seals in the rear pressure bulkhead.

h. Remove the tab cable stops and disconnect the chain and cable assembly at the trim tab actuator. Remove the aft cable and chain assembly.

i. Remove the bolt attaching the cable drum and sprocket to the lower pedestal. Note and record the number of cable revolutions on the reel.

j. Remove the cable through the pilot's compartment.

ELEVATOR TRIM TAB CABLE INSTALLATION (Figure 201)

a. Place the elevator trim tab control wheel in neutral position and wrap the cable around the drum the same number of revolutions noted during removal, maintaining the cable ends equidistant.

b. Position the cable drum and sprocket in the lower pedestal, with the chain and sprocket teeth engaged, and install the attaching bolt. Route the forward cable aft to the LH trim cable pulley located in the lower fuselage area. Route the aft cable aft to the RH trim cable pulley located in the lower fuselage area.

NOTE

When the trim tab control cable is disconnected at the pedestal, the tab wheel shall turn smoothly with very little resistance. Bearings not previously lubricated may be lubricated with MIL-L-6086 oil (7, Chart 207, 91-00-00). Lubricate shafts and thrust surfaces with MIL-G-23827 grease (11, Chart 207, 91-00-00) for friction reduction.

c. With the elevator tab in neutral, position the aft cable and chain assembly on the trim tab actuator sprocket so that the ends of the chain are equidistant at the sprocket centerline within ± .20 inch.

d. Route the chain and cable assembly inboard and forward in the aft fuselage.

e. Install all cable retaining pins in the pulley brackets.

f. Using PD680 solvent (15, Chart 207, 91-00-00), clean the cables for the length of travel through the pressure seals. Lubricate to one inch beyond the cleaned area with MIL-G-23827 grease (11, Chart 207, 91-00-00).

g. Fill the pressure seals with MIL-G-23827 grease (11, Chart 207, 91-00-00). Install the seals.

h. Install the cable stops and connect the cables to the turnbuckles in the aft fuselage. Rig the elevator trim tab control system.

NOTE

The force in line with the elevator tab cables required to move the cable shall not exceed 23 pounds measured with a hand held force gage, with or without electric trim.

i. Install the access panel in the floorboard aft of the rear spar, the floorboard between the main and aft spar, and the left passenger seat.

j. Install the left floorboard and the pilot's seat.

k. Install both upholstery panels on the pedestal.

l. Install the tail cone, the access plate beneath the RH horizontal stabilizer, and the access plate at the trim tab actuator.

ELEVATOR TRIM TAB RIGGING

NOTE

BEECHCRAFT recommends the use of the elevator travel gage shown in SPECIAL TOOLS in Chapter 12-20-00.

a. Place the elevator trim tab control in neutral position.

b. Place the elevator in neutral position and connect the trim tab to the trim tab actuator.

c. By turning the sprocket on the actuator, adjust the trim tab to both extremes of travel; measure both settings and return the tab to the mid-point of the two extremes of travel. This will place the actuator in the neutral position.

d. If the trim tab is not in the neutral position upon completion of step "c.", adjust the actuator push rod to place the tab in neutral position.

e. Center the chain on the sprocket and tighten the cable. Rig cable tension as noted on the Elevator Rigging Illustration, Figure 201.

f. Check trim tab travel, adjust stops and safety turnbuckles.

NOTE

Check the trim tab system for correct movement of the control surface with respect to the movement of the trim tab control. When the elevator tab control is moved toward the NOSE DOWN position, the tab should move up.

ELEVATOR TRIM TAB ACTUATOR REMOVAL

a. Remove the access plate at the trim tab actuator.

b. Remove the tail cone and the access plate beneath the RH horizontal stabilizer.

c. Remove the access panel in the floorboard aft of the rear spar.

d. Disconnect the tab control cables at the turnbuckles in the aft fuselage.

e. Disconnect the tab actuator at the tab.

f. Remove the bolt attaching the actuator to the elevator. Remove the actuator, and the chain and cable assembly from the actuator sprocket.

ELEVATOR TRIM TAB ACTUATOR INSTALLATION

a. Position the chain and cable assembly on the actuator sprocket so that the ends of the chain are equidistant at the sprocket centerline within ± .20 inch. Install the bolt attaching the actuator to the elevator.

b. Connect the actuator to the tab.

c. Connect the cables to the turnbuckles in the aft fuselage. Rig the tab control system.

d. Install the access panel in the floorboard.

e. Install the tail cone and the access plate beneath the RH horizontal stabilizer.

f. Install the access plate at the trim tab actuator.

ELECTRIC TRIM TAB ACTUATOR REMOVAL

a. Remove the access plate on the side of the fuselage beneath the RH horizontal stabilizer. The actuator is located on Fuselage Station 311.19 bulkhead adjacent to the trim tab cables.

b. Disconnect the actuator wire harness at the disconnect splices.

c. Disconnect the actuator cable at the turnbuckle, then tape the cable to the actuator to prevent the cable from unwinding.

d. Remove the three bolts securing the actuator to the bracket and remove the actuator from the airplane.

ELECTRIC TRIM TAB ACTUATOR INSTALLATION

a. Secure the actuator to the mounting bracket with the three attaching bolts.

b. Connect the actuator cables at the turnbuckles in the aft fuselage.

c. Connect the actuator wire harness at the splices.

d. Rig the tab control system.

NOTE

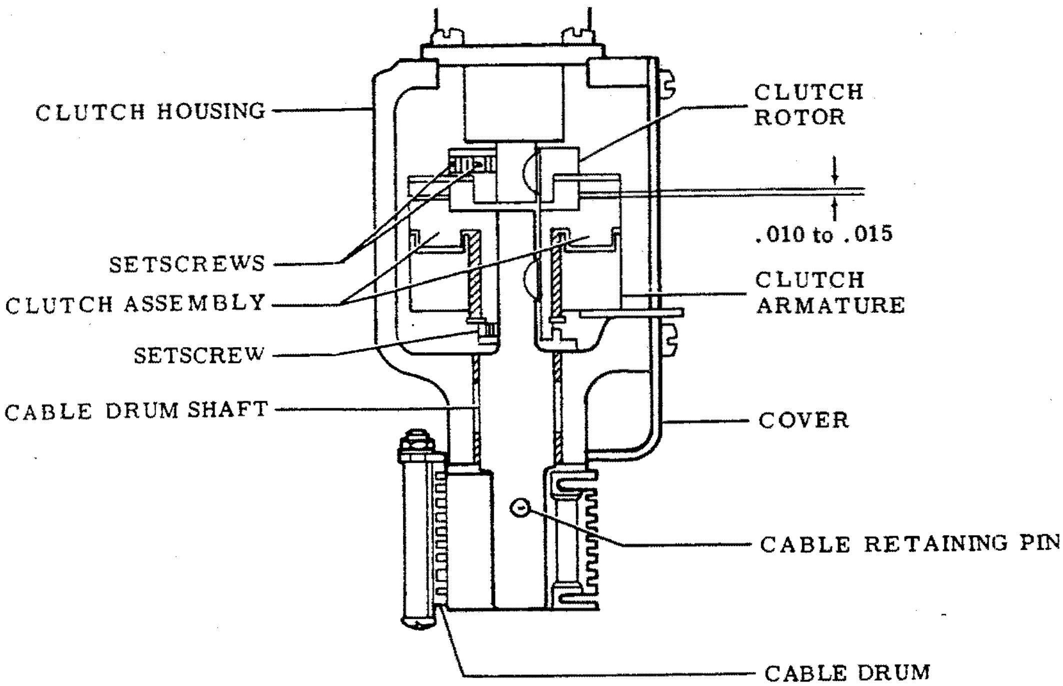
The tab rigging and cable tension are identical to the manually operated tab.

e. Check that the elevator trim tab cable travels from stop to stop in 18 to 20 seconds with 28.5 VDC applied to the airplane electrical system. If necessary, adjust the resistor mounted adjacent to the actuator until cable travel is within the desired limit.

f. Install the access plate beneath the RH horizontal stabilizer.

ELECTRIC TRIM TAB CABLE INSTALLATION

Note the position of the old cable on the cable drum in relation to the forward cable end fittings. Install the new



Electric Trim Tab Actuator
Figure 202

cable in the same position. This will ensure adequate free cable on the drum in both directions to allow full travel of the cable stops. Check cable travel as instructed in step "e." of the ELECTRIC TRIM TAB ACTUATOR INSTALLATION.

ELECTRIC TRIM TAB ACTUATOR MAGNETIC CLUTCH REMOVAL (Figure 202)

a. Remove the lid from the clutch housing.
b. Loosen the set screw in the clutch rotor and armature hubs.
c. Remove the motor from the clutch housing.
d. Slide the cable drum and shaft assembly from the clutch housing.
e. Remove the clutch from the clutch housing.

ELECTRIC TRIM TAB ACTUATOR MAGNETIC CLUTCH INSTALLATION (Figure 202)

a. Install the clutch in the clutch housing.
b. Slide the cable drum and shaft assembly into the clutch housing.
c. Tighten the clutch armature set screws until there is no visible end play in the cable drum shaft. Slide the clutch rotor on the motor shaft to obtain .010 to .015 inch clearance between the friction surfaces of the clutch before tightening the set screws. Stake both set screws.

CAUTION

With no visible end play in the cable drum shaft, the clutch faces must not make contact while the clutch is de-energized or damage to the clutch will result.

ELECTRIC TRIM TAB ACTUATOR MAGNETIC CLUTCH TORQUE TEST

The following procedure should be performed any time the magnetic clutch is replaced.

a. Connect the red electrical lead of the magnetic clutch to ground and the white electrical lead to a 28 VDC power source. Check that the clutch holds with 30 inch-pounds of torque applied through a torque wrench at the actuator shaft.
b. If the static torque of the clutch is less than 30 inch-pounds, burn in the clutch as follows:

1. Use a metal plate of sufficient thickness for rigidity and large enough to fit in a vise with the actuator

assembly attached. Anchor the plate in a vise and mount the actuator on the plate.

2. Insert the retaining pin in the actuator shaft.

3. Slot the end of the tube so that it will fit snugly into the .375 inch diameter hole in the end of the shaft.

4. Insert the tube into the shaft until the slot engages the retaining pins.

5. Attach the free end of the tube to a slow speed (approximately 450 rpm) half-inch drill motor.

6. Remove the access plate from the clutch housing and blow the housing and clutch clean.

7. Connect the red electrical lead of the clutch to ground and the white electrical lead to a regulated power source set at 14 to 16 VDC.

8. Start the drill motor and run for fifteen seconds, then remove the white lead from the power source. Let the clutch cool for approximately one minute before reattaching the lead for another fifteen second interval. Repeat the foregoing sequence until the clutch will hold 30 inch-pounds of torque as indicated in step "a", then blow the clutch and housing clean with compressed air.

CAUTION

Exceeding the fifteen second burn-in periods may overheat and damage the magnetic clutch.

CHECKING ELEVATOR TAB FREE PLAY

Visually inspect the elevator tabs for damage, security of hinge attach points, and for tightness of the actuating system. Inconsistancies should be corrected prior to checking the free play of the tabs. The elevator tab free play check should be performed at least once a year to ensure that the trim tab free play falls within the prescribed limits.

A check fixture (P/N 45-135030-9/810) or the equivalent as shown in Figure 203, a dial indicator, and a push-pull scale for applying accurate loading to the tab is required for making the inspection for free play of the tab.

a. Securely lock the control surfaces to prevent movement of the elevators. Set the elevator tabs in the neutral position.

b. Using shot bags, affix the dial indicator check fixture so that the dial indicator point is positioned 2.90 inches aft of the tab hinge line and on the outboard edge of the elevator tab.

c. Apply a small piece of masking tape (for paint protection) 4.50 inches aft of the tab hinge line and along the centerline of the tab actuator. This will be the point of pressure against the tab by the push-pull scale.

d. Apply another piece of masking tape in the corresponding position on the bottom surface of the tab for the same purpose.

e. Zero the dial indicator at no load initially. Do not reset during the checking procedure.

f. With the push-pull scale at the point of the masking tape, apply a full 3-pound downward load. Record the dial reading as "A".

g. Release half the load until a 1.5-pound downward load is obtained. Record the dial reading as "B".

h. Apply a full 3-pound upward load at the masking tape on the bottom surface. Record the dial reading as "C".

i. Release half the load until a 1.5-pound upward load is obtained. Record the dial reading as "D".

j. Enter the recorded values on a copy of Chart 201 and proceed as follows:

1. Multiply "B" by 2 and record as "2B".
2. Subtract "A" from "2B" and record as "X".
3. Multiply "D" by 2 and record as "2D".
4. Subtract "C" from "2D" and record as "Y".

NOTE

The results of "X" and "Y" can be negative numbers.

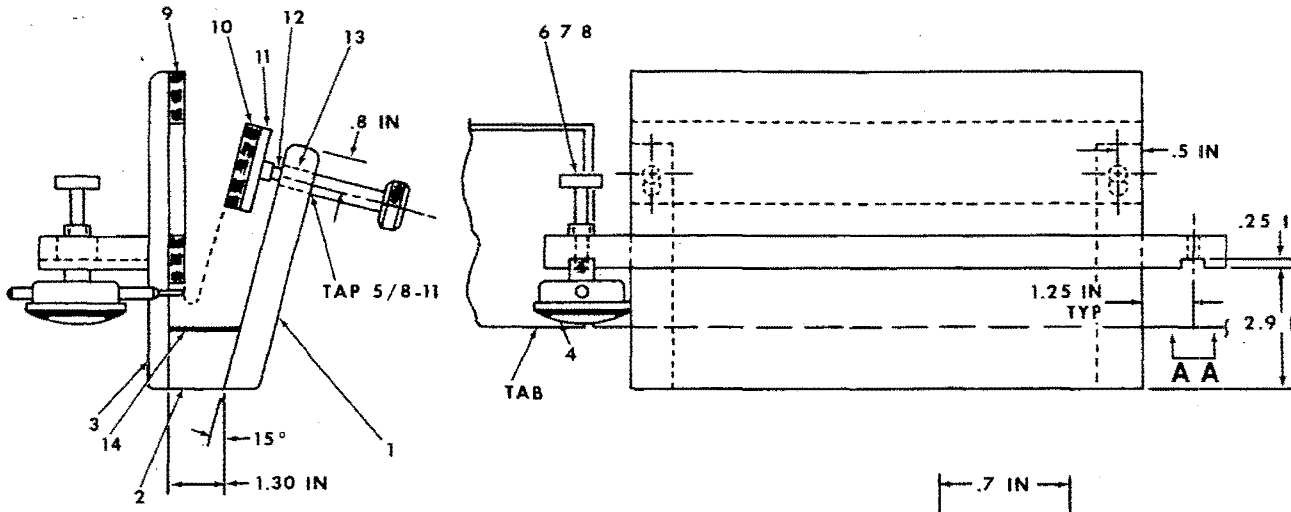
5. Add "X" and "Y" and record as "E".

CHART 201
ELEVATOR TAB FREE PLAY LIMITS

1.5 POUND READING	*3-POUND READING*	
B ________		
2B ________	−A ________	=X ________
D ________		
2D ________	−C ________	=Y ________
X ________	+Y ________	=E ________

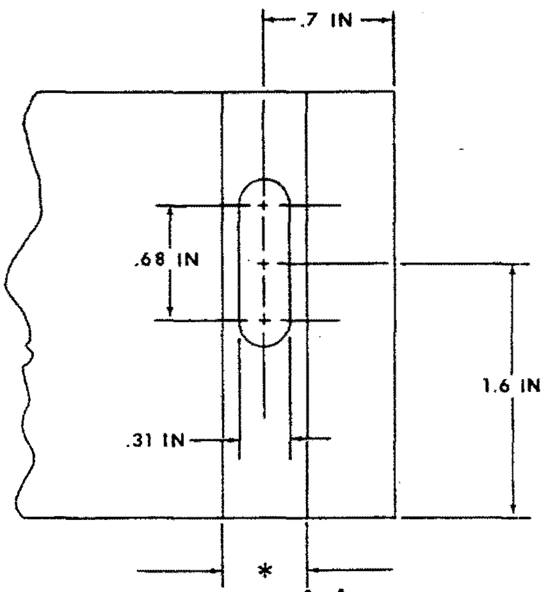
(E = 0.020 inch maximum).

k. If the elevator trim tab free play exceeds the 0.020 inch maximum noted above, inspect all components of the tab actuation system to determine the cause. All worn parts should be replaced.



ITEM NO.	QUANT.	DESCRIPTION
1	2	3/4 x 1 x 6 aluminum or equiv.
2	2	1 x 1 3/8 x 1 3/4 aluminum or equiv.
3	1	1/2 x 7 1/2 x 10 aluminum or equiv.
4	1	C81Q Indicator**
5	1	3/4 x 2 1/2 x 14 aluminum or equiv.
6	1	1/4 Dia. x 2 corrosion res. stl.
7	1	1/4 Dia. x 1 corrosion res. stl.
8	1	1/4-28 nut
9	1	3/8 x 5 x 10 rubber
10	1	3/8 x 2 x 10 rubber
11	1	1/4 x 2 x 10 corrosion res. stl.
12	2	1/2 x 13 x 3 VLIER Torque screw
13	2	KN813 Keensert or tap 1/2 - 13
14	2	1/8 x 1 x 3/4 rubber

**P/N of Federal Products Corp., Providence, R.I.



SECTION A A

* THIS GROOVE TO BE A SNUG FIT TO THE SCREW BRACKET ON THE DIAL INDICATOR

100-135-8

(P/N 45-135030-9/810) Check Fixture for Tab Deflection
Figure 203

"END"

FLAPS - DESCRIPTION AND OPERATION

The flaps consist of a section on each wing driven by a single electric motor. A flexible drive shaft extends from the motor assembly to a jackscrew actuator for each section. Limit switches, installed on the outboard side of the inboard flap track of the left wing panel, stop the flap travel at 0° (full up), 15° (approach), and 30° (full down) depending on the position of the flap control switch located to the right of the control console on the subpanel.

To indicate the position of the flaps on serials P-4 through P-246, an adjustable flap position transmitter is installed on the flap actuator in the right wing. An indicator on the right subpanel provides a visual indication of the flap position.

On serials P-247 and after, the position of the flaps are indicated by three indicator lights located on the right subpanel. The illumination of these lights are controlled by the flap limit switches. When the flaps are UP, all lights are out. A red TRANSIT light illuminates to indicate that the flaps are not in the selected position. The red TRANSIT light goes out and either the blue APH (approach) or the amber DN (down) light illuminates to indicate the flaps are in the position selected. The intensity of illumination is reduced for night operations when the NAV lights are turned on. The lights may be checked by pressing the PRESS-TO-TEST switch on the annunciator panel.

"END"

FLAPS - MAINTENANCE PRACTICES

FLAP REMOVAL

a. Fully extend the flaps and remove the bolt from the flap actuating arm.

b. Remove the bonding cable from the flap tracks.

c. Remove the bolts from the flap track brackets and remove the flap.

FLAP INSTALLATION

a. Hold flap in position and install the rollers and the bolts in the flap track bracket.

b. Connect the bonding cable and install the bolt in the flap actuating arm.

NOTE

The contour of the flap must be within .0625 inch of the contour of the wing on either or both sides. The inboard trailing edge of the flap must be within .20 inch above or below the trailing edge of the wing stub on either or both sides. The gap between the flap and aileron must be between .13 and .50 inch.

FLAP TRACK ROLLER INSTALLATION

Install the rollers (four per flap and two per track) in the flap track brackets with the flanges to the outboard side of the inboard track and to the inboard side of the outboard track. Install a 50-105000-3 washer between each of the aft rollers and its respective track. Use only the wide flanged rollers in the aft locations. The clearance between the roller and the front end of the forward slot in each track must be .03 to .12 inch.

FLAP CONTROL SYSTEM RIGGING

(Figure 201)

The flap limit switches are mounted on a bracket and installed on the outboard side of the inboard flap track in the left wing panel. The limit switches, one for up, two for the approach position, and one for down travel, control the travel of the flaps by breaking the circuit to the flap motor at the extreme limits of selected travel. The switches are accessible by lowering the flaps.

NOTE

An additional 16° limit switch is installed on serials P-247 and after.

The flap travel is adjusted by moving the limit switches. The left flap is rigged first and then the right flap is synchronized with it. Rig as follows:

NOTE

Rig the flaps under a simulated flight load to reduce overtravel to a minimum after the limit switches have been adjusted.

a. Adjust the up limit switch so the flap will stop approximately 3/32 inch from the forward portion of the slot on the inboard flap track.

b. Adjust the 14° limit (inboard) switch in its mounting slot until the flap is positioned at 14° to 14.5° after the flap has been actuated from the up to takeoff position (15° range). Adjust the 16° limit (outboard) switch(es) in its mounting slot until the flap is positioned at 15.5° to 16° after the flap has been actuated from the down to takeoff position.

c. Adjust the down limit switch in its mounting slots until it actuates at 28° to 30° of flap travel.

d. Remove the bolt attaching the right actuator to the right flap.

e. Turn the jackscrew on the right actuator in or out to align the right flap with the left.

f. Install the bolt connecting the actuator to the flap.

CAUTION

If flaps are removed for any reason the flap actuator switch should be in the "Neutral" position or the main power switch OFF.

NOTE

After the flap is completely rigged, adjust the rubber bumper (flap down) installed on the flap and aileron dividing rib. Turn the adjusting screw in or out as required to take out play or stop vibration when the flap is in the up position. A distinct change in sound of the flap motor near the completion of the flap up travel may indicate an excessive outward adjustment of the bumper.

FLAP FUNCTIONAL GROUND TEST

a. Connect a ground power unit (regulated at 28.25 ± .25 VDC) to the aircraft.

b. Check flap motor amperage during down and up cycles. (Maximum 7.0 amps down; 9.0 amps up.)

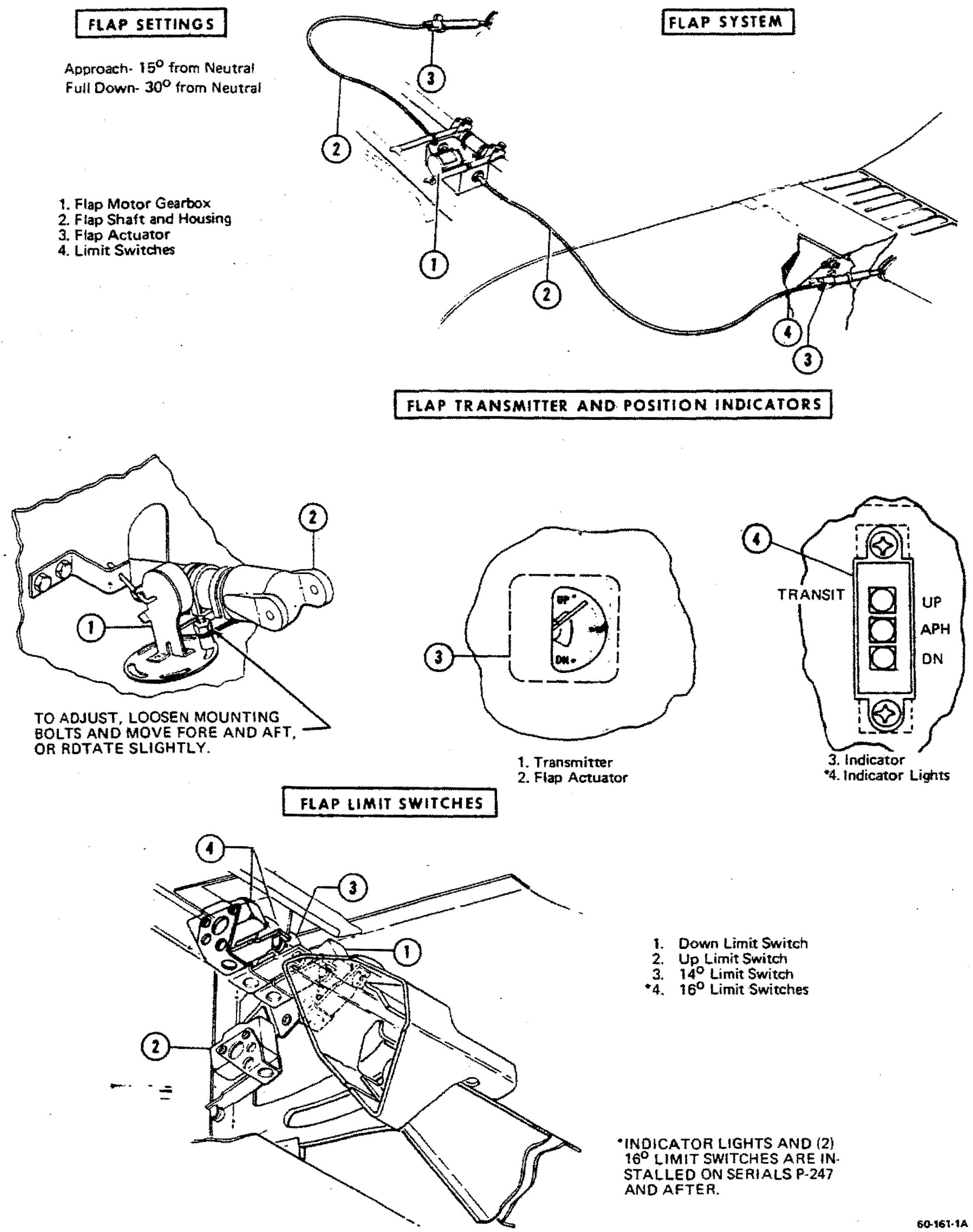
c. If the amperage is exceeded during the up or down cycle, the system must be inspected for excessive friction, rough flap tracks or misrigging.

d. Avoid continuous operation of the flaps to prevent overheating of the motor.

FLAP POSITION TRANSMITTER ADJUSTMENT (P-4 through P-246)

(Figure 201)

An adjustable flap position indicator transmitter is installed



Flap System
Figure 201

TEMPORARY REVISION NO. 27-2

Manual Affected: Duke 60 Series Maintenance Manual (60-590001-25)

Filing Instructions: Insert adjacent to 27-50-00, Page 203, dated Nov 2/73.

Reason: Revise procedures for flap drive cable connection.

FLAP DRIVE CABLE CONNECTION

Connect the LH and RH flap drive cables to the flap drive motor as follows, using the illustration for component locations:

a. Install the outboard nut and washer as far as it will go on the threaded portion of the flap cable.

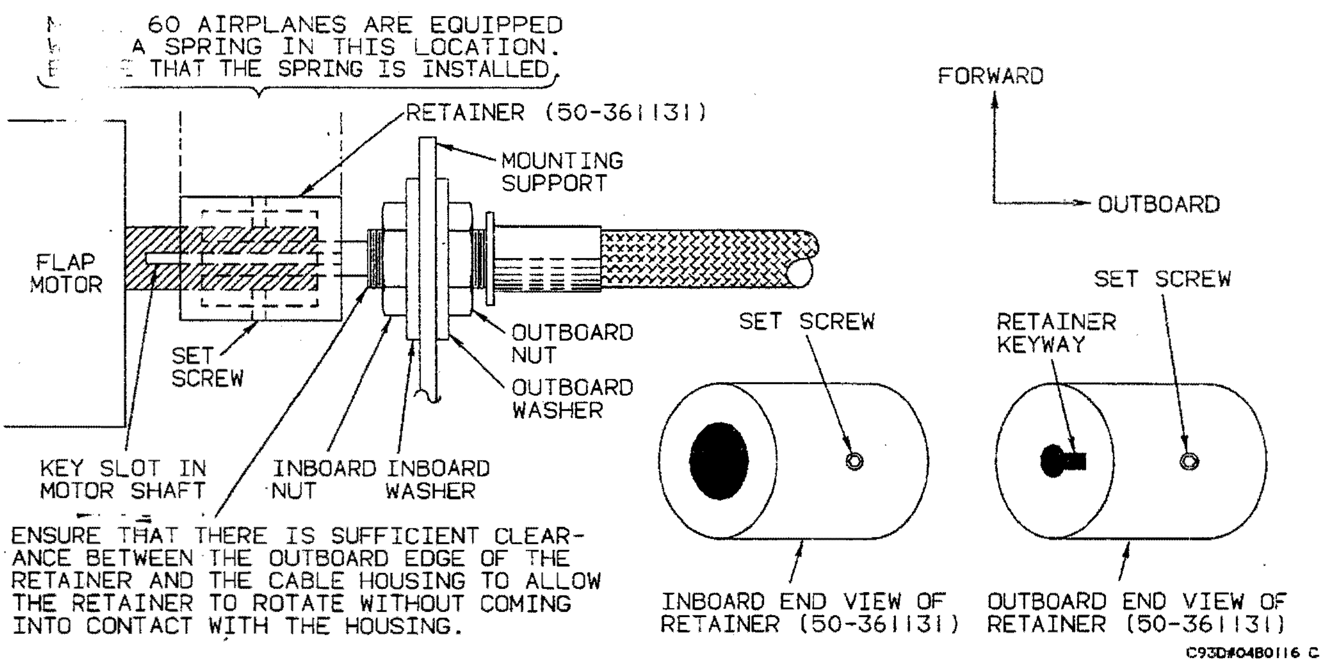
b. Insert the retainer through the mount support and onto the motor shaft as far as it will go. Align the retainer keyway with the key slot in the flap motor drive shaft and tighten one set screw temporarily.

c. While inserting the flap cable through the mount support, install the inboard washer and nut. Install the cable through the retainer and into the motor drive shaft until the keyway is just past the key slot in the retainer.

d. Loosen the set screw that was tightened in Step b. Ensure that the retainer is still installed on the motor shaft as far as it will go and rotate the retainer 90°.

e. Keep inboard pressure on the retainer and tighten both retainer set screws.

f. re the flap drive cable to the mounting support by tightening the nuts. Tighten the inboard nut to ensure that is sufficient clearance between the outboard edge of the retainer and the cable housing to allow the reta rotate without coming into contact with the cable housing. If the threaded part of the cable housing is not ough to install the two nuts and washers, using a die, add 5/8-24 UNEF threads until .88 inch thread leng ached. Tighten the outboard nut against the mounting support.



on the flap actuator in the right wing just forward of the rear spar.

a. Adjust the flap travel limit switches to provide the correct flap travel. (Refer to FLAP CONTROL SYSTEM RIGGING.)

b. Run the flaps down and check the pilot's compartment flap position indicator for 100% flaps. If full down flaps are not indicated, loosen the transmitter attachment bolts and adjust fore and aft or rotate slightly until the reading is correct, then tighten the transmitter attaching bolts.

c. Run the flaps up and check the indicator for up flaps reading.

FLAP POSITION INDICATOR LIGHTS - ADJUSTMENT AND FUNCTIONAL CHECK (P-247 and After)

(Figure 201)

The flap position indicator lights, installed on the right subpanel, provide the operator with a visual indication of the wing flap position. These lights are controlled by the flap limit switches.

a. Adjust the flap limit switches to provide the correct travel. (Refer to FLAP CONTROL SYSTEM RIGGING).

b. Select DN (down) position. Observe that the red TRANSIT light illuminates and remains illuminated until the amber DN (down) light illuminates.

c. Select the APH (approach) position. Observe that the amber DN (down) light goes out and the red TRANSIT light illuminates and remains illuminated until the blue APH (approach) light is illuminated.

d. Select the UP (full up) position. Observe that the blue APH (approach) light goes out and the red TRANSIT light illuminates. When the flaps are in UP (full up) position, the red TRANSIT light will go out.

FLAP ACTUATOR REMOVAL

a. Fully extend the flaps and disconnect the actuator from the flap.

b. Remove the access plate on the lower surface of the wing and uncouple the flexible drive shaft.

c. Remove the mounting bolts and actuator from the wing bracket. Remove the bushings from the actuator.

FLAP ACTUATOR INSTALLATION

a. Position the actuator in the wing bracket and install the bushings and attaching bolts.

b. Couple the flexible drive shaft to the actuator. Install the access plate on the lower surface of the wing.

c. Extend the actuator until the flap synchronizes with the opposite flap, then connect the actuator to the flap.

d. Check rigging of the wing flap control system.

e. If a new or overhauled actuator is installed, lift lightly on the flap trailing edge while running the flap through a complete extend-retract cycle. There should be no roughness or evidence of binding in the actuator.

FLAP MOTOR/GEARBOX REMOVAL

a. Gain access to the flap motor through the cabin floor panel at the rear spar carry through.

b. Disconnect the electrical wiring at the motor.

c. Remove the drive shaft retainers on each side of the gearbox and disconnect both flexible drive shafts from the support bracket.

d. Remove the four bolts, attaching the motor/gearbox to the support bracket, and remove the motor/gearbox as a unit.

FLAP MOTOR/GEARBOX INSTALLATION

a. Position the flap motor/gearbox against the support bracket and install the four bolts. Secure the bolts with safety wire.

b. Connect the flexible drive shafts to the gearbox and install the drive shaft retainers.

c. Connect both flexible drive shafts to the support bracket.

d. Degrease the retainer threads with primer (40, Chart 207, 91-00-00). Apply thread locking compound (36, Chart 207, 91-00-00) to the retainers prior to installation.

e. Connect electrical wiring at the motor.

f. Install the cabin floor access panel.

g. Perform a FLAP FUNCTIONAL GROUND TEST.

"END"

STALL WARNING SYSTEM - DESCRIPTION AND OPERATION

The stall warning system consists of a stall warning horn mounted forward of the instrument panel; a lift transducer, a lift transducer vane heater element, a face plate heater element on the leading edge of the left wing; a landing gear switch, a circuit breaker, and a stall and pitot switch located on the pilot's subpanel.

When aerodynamic pressure on the lift transducer vane indicates that a stall is imminent, the transistor switch is actuated to complete the circuit to the stall warning horn. The lift transducer senses the angle of attack and is triggered by reverse air flow.

CAUTION

The heater element protects the lift transducer from ice, however, a buildup of ice on the wing may disrupt the airflow and prevent the system from accurately indicating an incipient stall.

"END"

TROUBLESHOOTING
STALL WARNING SYSTEM

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Warning system inoperative.	a. Warning circuit breaker tripped.	a. If circuit breaker persists in tripping, check for grounded circuit.
	b. Open circuit.	b. Check for continuity.
	c. Defective warning horn switch.	c. Replace switch.
	d. Defective warning horn.	d. Replace horn.
2. Horn continues to blow.	a. Defective warning horn switch.	a. Replace switch.

"END"

STALL WARNING - MAINTENANCE PRACTICES

STALL WARNING INDICATOR REMOVAL

a. Remove the four screws attaching the doubler and indicator to the lower wing leading edge.

b. Disconnect electrical wires at the indicator and heater switches.

STALL WARNING INDICATOR INSTALLATION

a. Connect the electrical wires to the indicator and heater switches.

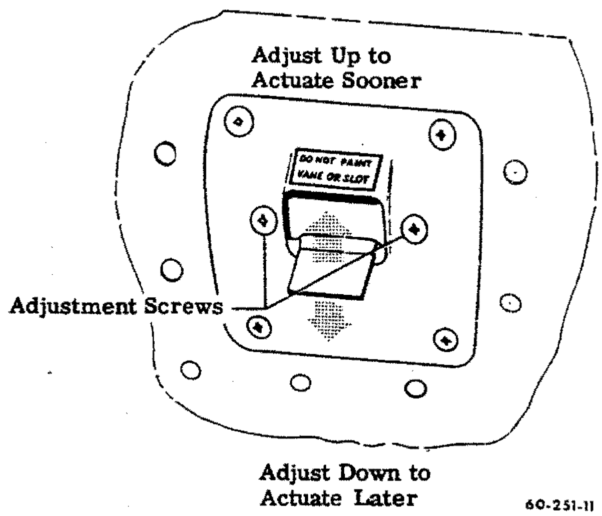
b. Position the indicator in the opening in the lower wing leading edge, install the doubler and the four screws.

c. Adjust the indicator. See STALL WARNING INDICATION SYSTEM ADJUSTMENT.

STALL WARNING INDICATING SYSTEM ADJUSTMENT

(Figure 201)

The stall warning switch is carefully adjusted when the airplane is test flown at the factory. Should it require readjusting, proceed as follows: Locate the switch installation on the under surface of the left wing leading edge and loosen the two phillips-head screws, one on either side of the vane. If the stall warning has been coming on too early, pull the vane back and down. If the stall warning has been coming on too late, push the vane up and forward. Moving the vane with the phillips-head screws loosened moves the entire unit up or down inside the wing, causing the switch to be closed earlier or later. Retighten the screws after making each adjustment. NEVER TRY TO ADJUST THE SWITCH BY BENDING THE VANE.



Stall Vane Adjustment
Figure 201

As a rule of thumb, moving the vane 1/4 inch will change the time the stall warning actuates by about 4.4 knots of indicated air speed. The only way to test the accuracy of the setting is to fly the airplane into a stall, noting the speed at which the warning horn comes on and the speed at which the full stall occurs. The stall should be made with the flaps and gear up and power off. Prior to stalling, decelerate no faster than one knot per second. It may be necessary to make several alternate adjustments and test flights before the desired setting can be reached. The stall warning should actuate at 5 to 7 knots ahead of the complete stall. The switch setting should be checked and adjusted as necessary whenever a wing or wing leading edge is replaced or extensively repaired, or if a new switch is installed. The switch should require no adjustment in normal service.

"END"

GUST LOCK AND DAMPENER - MAINTENANCE PRACTICES

If it is necessary to park the airplane outside for extended periods, install the control locks and tie down the airplane. Installing control locks may be done as follows:

a. Insert the spring end of the rudder control locking pin into the hole at the top of the pilot's left rudder pedal arm.

b. Neutralize the pedals with the locking pin spring compressed and insert the opposite end of the locking pin into the right pedal arm. The rudder pedals locking pin is placarded RUDDER PEDALS LOCKED.

c. Position the throttle control lock, placarded THROTTLE CONTROLS STOP, forward of the throttle levers in the closed position and secure it to the console with the Dzus fastener.

d. The aileron control locking device, placarded AILERON AND ELEVATOR CONTROLS LOCKED, is installed by inserting the pin through a hole in a flange protruding from the subpanel, and through a matching hole in the lower side of the control column tube.

To remove the control locks, remove in the following order: rudder, aileron/elevator and throttle.

"END"

CHAPTER 28

LIST OF PAGE EFFECTIVITY

"END"

CHAPTER 28 - FUEL

TABLE OF CONTENTS

CHAPTER 28 - FUEL

TABLE OF CONTENTS (Cont'd)

"END"

GENERAL - MAINTENANCE PRACTICES

FUEL HANDLING PRACTICES

When filling the aircraft fuel cells, always observe the following:

a. Service the fuel cells with 100/130 octane fuel or if not available, use 115/145 octane fuel (1, Chart 207, 91-00-00).

b. Make sure the aircraft is statically grounded to the servicing unit.

c. Do not fill fuel cells near open flame or within 100 feet of any open energized electrical equipment capable of producing sparks.

d. Do not insert the fuel nozzle more than 3 inches into the filler neck; to do so may cause damage to the rubber fuel cell.

Most fuel injection system malfunctions can be attributed to contaminated fuel. Inspecting and cleaning the fuel strainers should be considered to be of the utmost importance as a regular part of preventive maintenance.

Normally the fuel strainers should be inspected and cleaned every 100 hours. However, the strainers should be inspected and cleaned at more frequent intervals depending on service conditions, fuel handling equipment and when operating in localities where there is an excessive amount of sand or dust.

Open each of the seven snap-type fuel drains daily to allow condensed moisture to drain from the system.

NOTE

If the cells are to remain unfilled for 10 days or more, apply a thin coating of light engine oil to the inside surface of the cell to prevent deterioration and cracking.

AIRCRAFT DEFUELING

To insure that all fuel is removed from the system, the fuel should be drained through the boost pumps. To expedite the defueling operation, the boost pumps may be used to pump the fuel out of the system. The following steps must be accomplished before energizing the pumps:

a. Apply external power to the aircraft electrical system.

b. Place the fuel selector valve in the "ON" position and the mixture lever in "IDLE CUT-OFF".

c. Remove the filler caps to vent the system.

d. Disconnect the fuel line at the firewall and attach a drain hose. Provide a suitable container for the fuel.

e. Energize the boost pumps.

f. When fuel is no longer pumped from the aircraft, open the sump drains to complete the defueling operation.

"END"

STORAGE - MAINTENANCE PRACTICES

NACELLE FUEL CELL REMOVAL
(Figure 201)

a. Drain and purge the fuel cell.

b. Remove the fuel cell access plate (1), the forward access plate (2) and the vent line access plate (3).

c. Remove clamp from 3-inch interconnect tube in bottom of cell and the vent nipple clamp and interconnect line in wheel well.

d. Remove the fuel transmitter. (Refer to 28-40-00).

e. Unsnap the fuel cell and remove it from the nacelle cavity through the access hole (1).

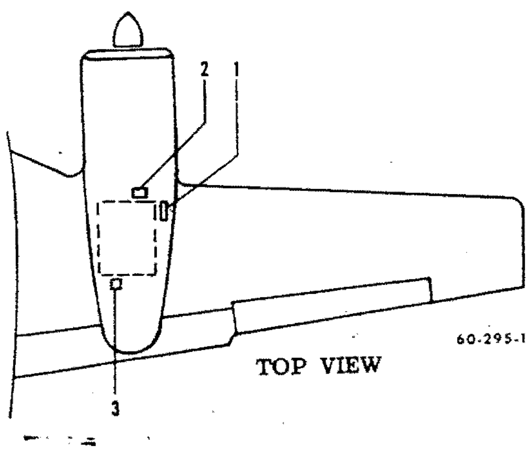
NOTE

Tape edge of access hole to protect cell from damage during removal.

If the fuel cell is to be stored for a period of 10 days or longer, coat the inside of the cell with light engine oil to prevent cracking or deterioration.

NACELLE FUEL CELL INSTALLATION

a. Carefully insert the fuel cell into the nacelle cavity, through access hole (1), and snap in place.



1. Fuel Cell Access and Transmitter
2. Forward Access Plate
3. Nacelle Vent Line Access Plate

**Nacelle Fuel Cell Access Openings
Figure 201**

b. Install the fuel transmitter. (Refer to 28-40-00).

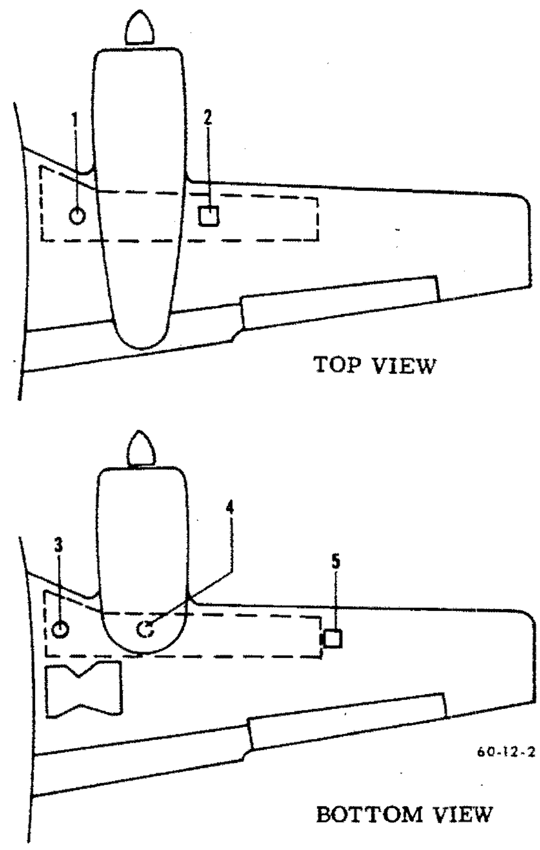
c. Install fuel cell access plate (1).

d. Connect 3-inch interconnect tube at bottom of fuel cell, and vent nipple and interconnect line in wheel well. Torque rubber fuel nipples and interconnect clamps to 25± 5 inch-pounds.

e. Install forward access plate (2) and vent line access plate (3).

INBOARD LEADING EDGE FUEL CELL REMOVAL
(Figure 202)

a. Drain and purge the fuel cell.



1. Access Plate and Transmitter.
2. Fuel Cell Access and Transmitter
3. Fuel Pump
4. Fuel Cell Access Plate (Under Removable Aft Nacelle Section)
5. Fuel Cell Access Plate

**Inboard Leading Edge Fuel Cell
Access Openings
Figure 202**

b. Remove the inboard and outboard fuel transmitters. (Refer to 28-40-00).

c. Remove the fuel boost pump. (Refer to 28-20-00).

d. Remove the clamp and the fuel cell drain valve.

NOTE

On serials P-231 and after, a spacer is installed between the drain valve clamp and the fuel cell liner washer to prevent the drain valve from being pushed into the tank.

e. Remove the lower aft nacelle section and the fuel cell access plate (4).

f. Remove the cotter pin securing the flapper check valve assembly to the internal inboard interconnect. Remove the interconnect clamp.

g. Remove the outboard internal interconnect clamp through the fuel access hole (2).

h. Remove the fuel access plate (5).

i. Disconnect all fuel and vent plumbing.

j. Remove screws and bolts attaching the fuel cell outlet plate to the fuel cell.

k. Unsnap the fuel cell and remove the cell through the fuel access hole (2).

NOTE

Tape edge of fuel cell liner and access hole to prevent damage to the fuel cell.

l. Check the flapper check valve collar and valve hinge strap for parallelism within .03 inch. Check the valve for an opening of 35 ± 10 degrees.

NOTE

If the fuel cell is to be stored for a period of 10 days or longer, coat the inside of the cell with light engine oil to prevent cracking or deterioration.

INBOARD LEADING EDGE FUEL CELL INSTALLATION

CAUTION

Exercise caution when installing baffled fuel cells to prevent damage to the flapper valve.

a. Carefully insert the fuel cell through the fuel cell access hole (2) and snap the cell in place.

b. Install the fuel cell outlet plate with screws and bolts. Torque to 20 to 30 inch-pounds. Safety wire the bolts.

c. Connect all fuel and vent plumbing. Torque the rubber fuel fitting nipples to 25 ± 5 inch-pounds.

d. Install the outboard internal interconnect clamp through fuel access hole (2).

NOTE

Torque interconnect clamps to 25 ± 5 inch pounds.

e. Install the inboard internal interconnect clamp.

f. Install the flapper check valve with a new cotter pin. Check the valve for freedom of movement and for proper seating.

NOTE

The flapper check valve must hinge downward.

g. Install the fuel cell access plate (4). Torque to 45 to 55 inch-pounds and safety wire.

h. Install the lower aft nacelle section.

i. Install the fuel cell drain valve and clamp.

j. Install the fuel boost pump. (Refer to 28-20-00).

k. Install the inboard and outboard fuel transmitters. (Refer to 28-40-00).

INSTALLATION OF VELCRO TAPE WITH REPLACEMENT FUEL CELLS (P-4 through P-195)

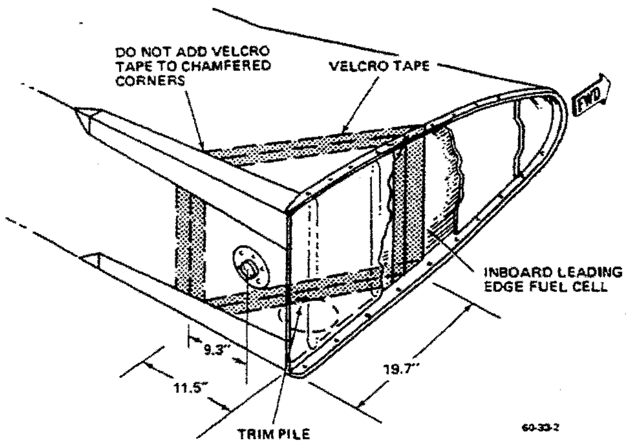
(Figure 203)

Aircraft that have or will have the existing inboard leading edge fuel cells replaced with spare fuel cells P/N 58-380030-7, 58-380030-8, 58-380030-9, and 58-380030-10 should install Kit 60-9002-3 S in the fuel cell liner top, bottom, root rib, and spar as described below and in Service Instructions No. 0585-281. If only one fuel cell is to be replaced, use Kit 60-9002-1 S for left hand installation and Kit 60-9002-2 S for right hand installation. Serials P-196 and after are delivered from the factory with the equivalent of Kit 60-9002-3 S installed.

a. Remove the fuel cell as described in INBOARD LEADING EDGE FUEL CELL REMOVAL.

NOTE

Aircraft that have had any of the above fuel cells installed do not require complete removal of the fuel cell. Access covers and inboard fittings should be removed and the inboard end of the fuel cell pulled back far enough to allow installation of the velcro tape.



Installation of Velcro Tape
Figure 203

b. Lightly sand the surface that the velcro tape will be bonded to as shown in Figure 203 and thoroughly clean the sanded surface with toluol (22, Chart 207, 91-00-00).

c. Apply a coat of cement (39, Chart 207, 91-00-00) to the cleaned surface.

d. Activate the velcro tape by dipping into a bath of MIL-M-13999 methyl ethyl ketone (21, Chart 207, 91-00-00) and press the backing of the velcro tape to the cemented surfaces. Allow 15 minutes (minimum) for drying to ensure a good bond.

e. Position the fuel cell in place and press the velcro hook and pile together by pressing outward in the area of the velcro tape.

f. Inspect the flapper valve for freedom of movement under its own weight. If the flapper valve binds, refer to INBOARD LEADING EDGE FUEL CELL FLAPPER VALVE INSPECTION.

NOTE

Before closing the zipper, inspect the cavity inboard of the baffle for foreign material.

g. Close the zipper and refer to INBOARD LEADING EDGE FUEL CELL INSTALLATION for further instructions on installing the fuel cell.

NOTE

Installation of Kit 60-9002-3 S is required on a first time basis only. Repeat installations of the kit are unnecessary when new fuel cells are installed.

h. Make the appropriate log book entry.

i. After installation of baffled fuel cells, change the usable fuel placards on the filler caps and fuel selector valve as instructed in Service Instructions No. 0559-281.

INBOARD LEADING EDGE BAFFLED FUEL CELL - FLAPPER VALVE INSPECTION

On aircraft that are equipped with baffled fuel cells, the flapper valves should be inspected periodically (Beech Aircraft recommends that the inspection be accomplished at each annual inspection) for freedom of operation and proper seating. The inspection may be accomplished as follows:

a. Remove the fuel boost pump (refer to 28-20-00).

b. Open the zipper in the fuel cell baffle.

c. Locate the flapper valve in the lower aft portion of the baffle and determine whether the valve element is metal or phenolic.

d. If the flapper valve element is metal, it should be inspected and repaired, if necessary, as described below:

1. Move the flapper valve element through its full travel. There should be no binding and the element should seat flush against the valve plate.

2. If the flapper valve element binds and/or does not seat properly, the element arm could be bent. The arm can be straightened by placing a screwdriver between the arm and element and pressing the element toward the closed position.

3. If after straightening the arm, the element still binds and/or does not seat properly, the element should be removed and replaced with a new element. The element may be replaced by removing the two bolts from the upper part of the flapper valve assembly. The same attaching parts should be used to install the new element. The new flapper element should be inspected after installation, to determine that it was not damaged during installation which could cause it to bind and/or not seat properly.

e. If the flapper valve element is phenolic, it should be inspected and reworked, if necessary, as described below:

1. Move the flapper valve element through its full travel. There should be no binding and the element should seat flush against the valve plate.

2. If the flapper valve element binds and/or does not seat properly, the upper rear side of the element may be binding against the valve plate.

3. The flapper valve element may be relieved from binding by filing a small radius on the upper rear side of the element.

NOTE

A shop towel saturated with light oil may be placed directly below the flapper valve to absorb the phenolic dust during rework.

4. After determining that the flapper valve is functioning properly, thoroughly wipe the area in the vicinity of the flapper valve with an oil saturated shop towel.

f. Close the zipper in the main fuel cell baffle.
g. Clean the gasket contact areas on the fuel cell and the fuel boost pump.
h. Install the fuel boost pump (refer to 28-20-00).

BOX SECTION FUEL CELL REMOVAL
(Figure 204)

a. Drain and purge the fuel cell.
b. Remove the access plate (1).
c. Remove the inboard (2) and outboard (3) access plates on the underside of the wing.
d. Remove the fuel cell plates and remove the internal fuel cell interconnect clamps.

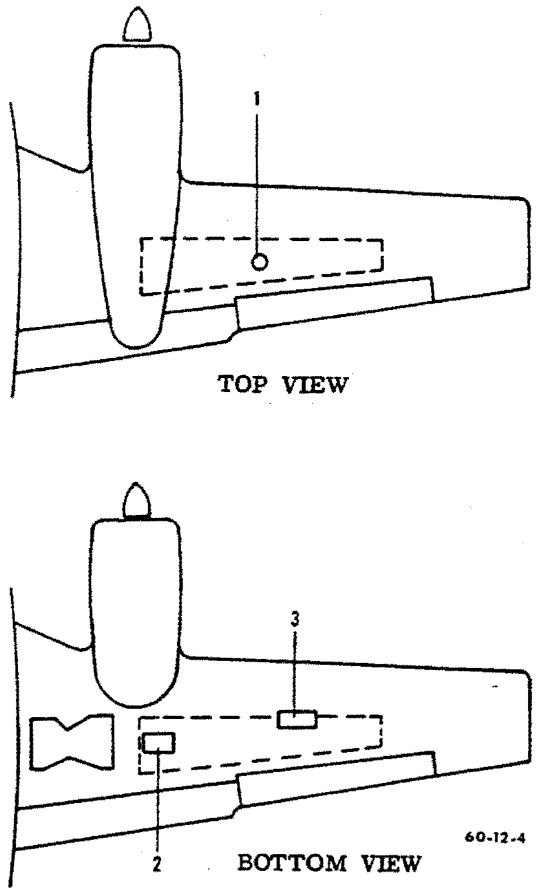
NOTE

On later Duke A60's, beaded interconnects are incorporated in the fuel system so that fuel cells aft of the main spar can be attached without opening the leading edge cavities.

e. Disconnect the drain and vent plumbing.
f. Unsnap the fuel cell and remove it from the wing cavity through the outboard access hole (3).

NOTE

If the fuel cell is to be stored for a period of 10 days or longer, coat the inside of the cell with light engine oil to prevent cracking or deterioration.



1. Access Plate
2. Box Section Cell Inboard Access
3. Box Section Cell Outboard Access

Box Section Fuel Cell Access Openings
Figure 204

BOX SECTION FUEL CELL INSTALLATION

a. Carefully insert the fuel cell into the wing cavity through the outboard access hole (3), and snap in place.
b. Connect all fuel and vent plumbing. Torque the rubber fuel fitting nipples to 25± 5 inch-pounds.
c. Install the internal fuel cell interconnect clamps. Torque clamps to 25 ± 5 inch-pounds.
d. Install the inboard (2) and outboard (3) access plates on the underside of the wing. Torque access plates to 45 to 55 inch-pounds.
e. Install access plate (1).

OUTBOARD LEADING EDGE FUEL CELL REMOVAL
(Figure 205)

a. Drain and purge the fuel cell.
b. Remove the screws securing the filler neck (3) to the wing skin.
c. Remove the access plates (2) and the fuel and vent plumbing access plate (1) on the underside of the wing.
d. Disconnect the fuel and vent plumbing.
e. Remove the internal fuel cell interconnect clamps.

g. Install and secure access plates.

h. Pressurize the fuel system using 0.50 + 0.25 - 0.00 psig. There should be no pressure loss in 15 minutes.

i. Fuel and restore electrical power to the airplane as required.

LEAK TEST
(Figure 207)

a. Ensure that all repairs to the wet wing tip are completed and sealed.

b. Connect pressure source to the wet wing tip as shown in Figure 207.

CAUTION

Ensure that the filler cap and access plate are secure. This test should be done when the wet wing tip is removed from the fuel system of the airplane.

c. Apply 3.73 ± 0.25 psig to the wet wing tip for 5 minutes.

d. Apply leak detector compound MIL-L-25567 (14, Chart 207, 91-00-00) to the outside of the wet wing tip.

e. Mark all leaks as indicated by bubbles.

f. Depressurize the wet wing tip, locate and repair leaks (see Figure 206).

g. Repeat the pressurization test procedure and repair leaks until there is no leakage.

h. Rinse leak detector compound off wet wing tip with clean water and wipe dry with clean cloths.

i. Install wet wing tip on airplane.

LEAKAGE CHECKS AND REPAIRS (WET WING TIP)
(Figure 208)

To classify the degree of leakage in a wet wing tip fuel cell, measure the size of the wet area around the leak. A more accurate measurement may be obtained by wiping the leakage clean and applying talcum powder in the area of the leak. After 30 minutes, recheck the area to determine if the leak classifies as a stain, seep, heavy seep or running leak as indicated in Figure 208. Fuel leaks must also be classified as to whether they occur in an open area or in an enclosed area to differentiate between those that require immediate repair and those not considered potential flight hazards.

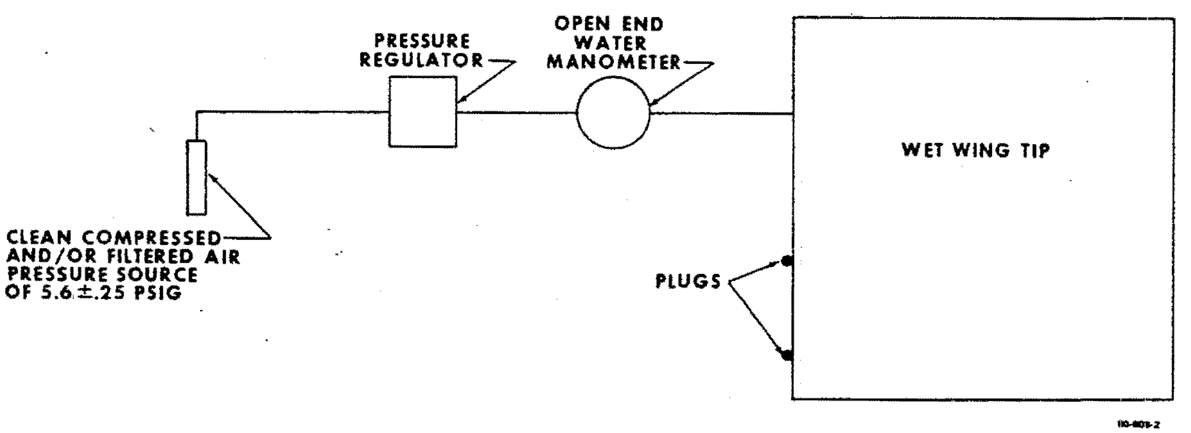
WARNING

Any leakage in an enclosed area, such as the wheel well, or in an area where the fuel will blow into the fuselage, requires grounding until repair is made.

a. Repair of heavy seeps or smaller leaks in an open area may be delayed until the airplane is down for other maintenance.

b. Any leakage in an enclosed area requires immediate grounding and repair.

c. Remove any sealant around the leak with a sharp, nonmetallic tool, such as a tool of chisel-shaped Formica.



Leak Test Set-up
Figure 207

Scarf the ends of the existing fillet so that a new sealant can form a continuous and smooth tie-in. PR-890B-1/2 (19, Chart 205, 91-00-00) or EC-1675B-1/2 (20, Chart 205, 91-00-00) is recommended for the sealing process. Thoroughly clean the area to be repaired with methyl ethyl ketone or naphtha prior to sealing. The following repairs are permissible:

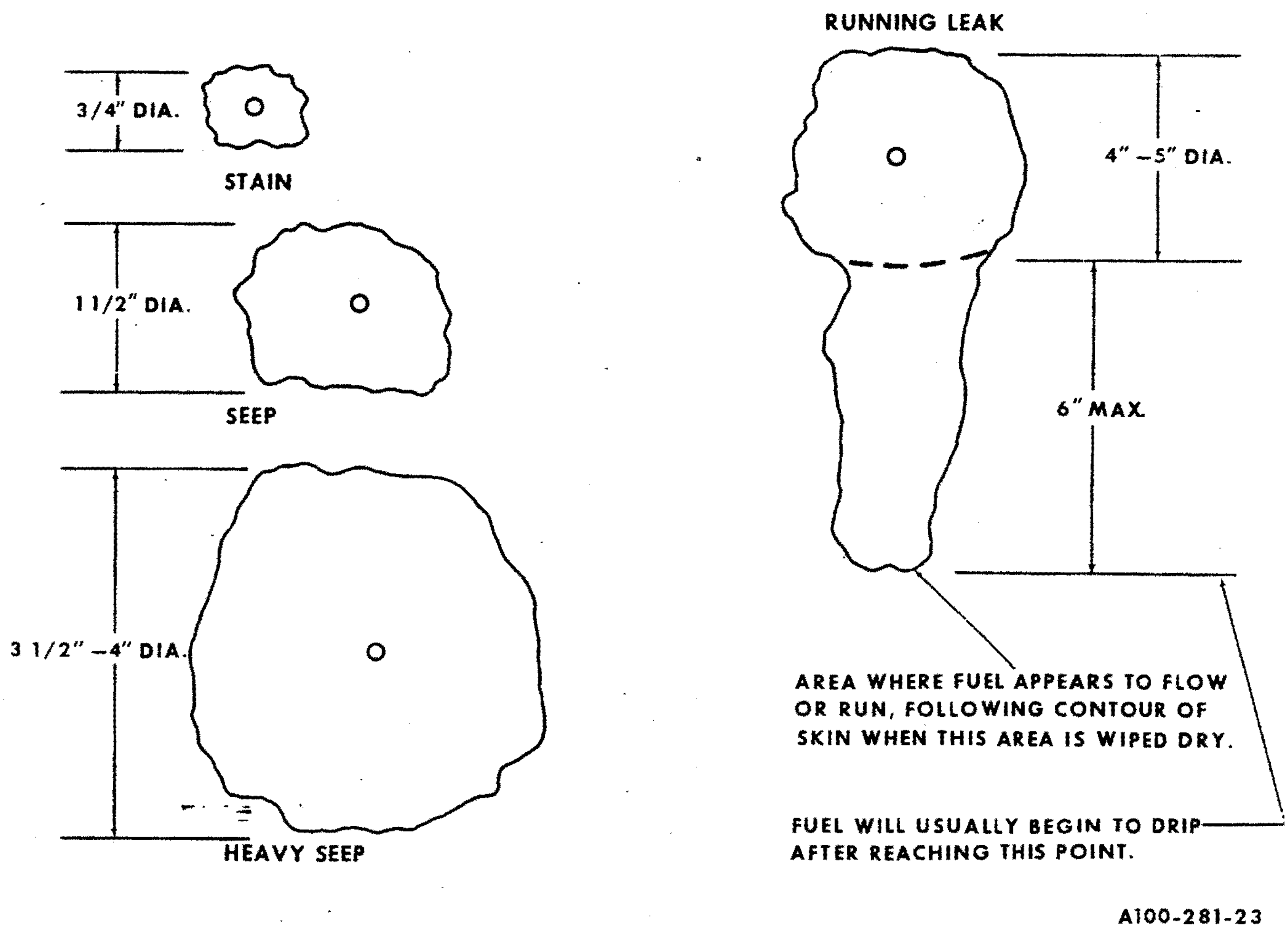
1. If the leakage is around a rivet, restrike the rivet. This can only be done once. If the leak persists, replace the rivet.
2. If the leakage is around a bolt with a gasket type seal, retorque the bolt. If the leak persists, replace the seal or the bolt.
3. If the leakage is at the gasket around an access opening or fitting, retorque the attaching hardware. If the leak persists, replace the gasket.

FUEL CELL LEAKAGE CHECK

Although the chemical test is more sensitive, either of the following test procedures may be used to detect leaks in the bladder cells.

a. Soapsuds Test.

1. Attach test plates to all fittings.
2. Inflate the cell with air to a pressure of 1/4 psi maximum.



Leakage of Wet Wing Tip Fuel Cell
Figure 208

3. Apply a soap and water solution to all repaired areas and any areas suspected of leakage. Bubbles will appear at any point where leakage occurs.

4. After test, remove all plates and wipe soap residue from the exterior of the cell.

b. Chemical Test

1. Attach test plates to all fitting openings except one.

2. Pour ammonia on the absorbent cloth in the ratio of 3 cc per cubic foot of cell capacity. Place the saturated cloth inside the cell and install the remaining test plate.

3. Make up a phenolphthalein solution as follows: add 40 grams phenolphthalein crystals to 1/2 gallon of ethyl alcohol, mix, then add 1/2 gallon of water.

4. Inflate the cell with air to a pressure of 1/4 psi maximum.

5. Soak a large white cloth in the phenolphthalein solution, then wring it out thoroughly and spread it smoothly on the outer surface of the cell. Press the cloth down to insure detection of minute leaks.

6. Check the cloth for red spots which will indicate a leak. Mark any leaks found and move the cloth to a new location. Repeat this procedure until the entire exterior surface of the cell has been covered. If red spots appear on the cloth, they may be removed by resoaking the cloth in the solution.

7. The solution and test cloth are satisfactory only as long as they remain clean. Indicator solution that is not in immediate use should be stored in a closed container to prevent evaporation and deterioration.

After the test, remove all plates and test equipment. Allow the cell to air out.

NOTE

In conducting the tests outlined above, the cell need not be confined by a cage or jig, providing the 1/4 psi pressure is not exceeded.

FUEL CELL REPAIR

GOODYEAR FUEL CELLS

The following items for field repairable injuries (inside or outside) are permissible. Damaged cells, not covered by these items should be returned to the Goodyear Tire And Rubber Company, Rockmart, Georgia, for repair.

a. Punctures.
b. Slits - to maximum 3 inch length.
c. Abraided holes.
d. Loose hangers and glove snaps (hot repair only).

Repair the fuel cell as follows:

a. Thoroughly clean the damaged area, (at least one square foot surrounding the injury) with methyl ethyl ketone solvent. Three washings are recommended to assure cleanliness.

b. Cut a patch from repair material furnished in repair Kit No. 2F1-2-31853, large enough to extend beyond damaged area by 2 inches in all directions. The patch should be thinned toward the edges.

c. Place the dull or gum stock side of the patch next to the cell. Wash the patch thoroughly in methyl ethyl ketone.

NOTE

No patch is required for loose hanger or glove snap repair, but heat must be used for curing.

d. Mix the cement in the following proportions and sequence. Use one quart can containing 272 grams of 2342C, heat if necessary to liquify. To this, add one can of 2233C (185cc) and stir until smooth (a minimum of 5 minutes is required).

e. Apply two evenly brushed coats of cement to the cell and patch surface. Allow 30 minutes drying time between the second coat and the application of patch (do not use cement after it has been mixed more than two hours).

f. Center repair patch over repair area and roll down firmly using the 1 inch stitcher. Start rolling from center of patch to the outside edge. This will remove any trapped air. Hanger or glove snap repairs use the same cementing and drying time as regular repair but will require heat for curing.

g. Place cellophane over repair and on inside of cell under repair. It is very important that the cellophane on the inside of the cell be placed under the repair area, thus preventing the two inside surfaces of the cell from being cemented together. Over the outside cellophane place the 1/4 inch cloth-backed foam rubber, cloth side up. Over the foam rubber place a 1/4 x 6 x 6 aluminum plate and place a "C" clamp (8 inch min. clamp) over the metal plate and underneath the work bench top. With patch and plate centered over repair area, tighten the "C" clamp until cement is forced out under edges of the repair (let cure for 72 hours).

NOTE

Air cured repairs are to be made at room temperature of approximately 75°F. Add 25% to the cure time for each 10° drop in temperature.

If heat is used for curing, insert element from No. 2F1-3-25721 cure iron (contained in Kit 2F1-2-31234) between "C" clamp and metal plate, then tighten "C" clamp until cement is forced out from edges of the patch. Cure for 2 hours at 240°F. Allow iron to cool for 15 to 20 minutes before removing. Remove iron, metal plate, foam rubber and cellophane. Dampen cellophane with water, using a sponge, and remove by peeling off. Loose edges of patch up to 1/4 inch maximum may be trimmed off and buffed smooth. Protect area of tank ~~around buffed area~~ with masking tape. Loose edges exceeding 1/4 inch may be recemented using the same cure procedure as previously used.

Storage and Handling: Prior to storage, clean the cell with warm water and soap. Dry and wrap in as small a package as possible and place in a cardboard box. Store in a cool dry room away from any electric motor that might be in operation.

Materials and Equipment needed for repair:

a. Air Cure: (Kit 2F1-2-31853)

QUANTITY	*NOMENCLATURE*	*GOODYEAR PART NO.*
2Qts.	Cement	2342C
2-1/2 Pts.	Mixture	2333C
2 Bottles	Mixture	2315C
2 (1 Pts.)	Methyl Ethyl Ketone	
1 Sheet 12" x 12"	Patch	BTC39
1 Sheet 12" x 24"	Cellophane	
1 Sheet 1/4 x 12" x 12"	Foam Rubber Cloth Back	

b. Heat Cure: (Kit No. 2F1-2-31234). Kit consists of all the above items listed in the air cure repair kit, plus the following items:

QUANTITY	*NOMENCLATURE*	*GOODYEAR PART NO.*
1	1" Paint Brush	
1	1" Stitcher	
1	Cure Iron (240°F)	2F1-3-25721
2	1/4" x 6" x 6" Aluminum Plate	

UNIROYAL FUEL CELLS

For repairs of Uniroyal fuel cells, refer to Uniroyal Handbook, Recommended Handling and Storage Procedures for Bladder Type Fuel and Oil Cells P/N FC 1473-73.

"END"

DISTRIBUTION - MAINTENANCE PRACTICES

FUEL BOOST PUMP REMOVAL

a. Drain and purge the fuel system for the appropriate wing.

b. Make sure the electrical power to the boost pump is off.

c. Remove the pump access cover on the underside of the wing.

d. Disconnect the electrical leads to the pump.

e. Cut the safety wire from around the retaining bolts and remove the bolts.

f. Pull the pump down far enough to gain access to the pump outlet line.

g. Disconnect the outlet line and remove the pump.

FUEL BOOST PUMP INSTALLATION

a. Clean the gasket contact areas on the fuel cell and the fuel pump.

b. Connect the fuel outlet line to the fuel boost pump.

c. Install the boost pump with new gaskets. Torque the bolts to 45 to 55 inch-pounds and safety wire.

d. Connect electrical leads to the pump.

e. Install the pump access plate on the underside of the wing.

ENGINE DRIVEN FUEL PUMP REMOVAL

a. Access to the engine-driven fuel pump is gained through the right cowl door on each nacelle.

b. The fuel pump is located at the rear, on the lower right side of the engine.

c. Disconnect the fuel inlet, outlet and drain plumbing from the pump. Remove the fuel pump heat shield.

NOTE

The 60-910031-3 elbow in the inlet port of the fuel pump is not a reusable part. Anytime the elbow is loosened or removed, it should be replaced with a new part.

d. Remove the pump retaining nuts and remove the pump.

ENGINE DRIVEN FUEL PUMP INSTALLATION

a. Install the fuel pump, on the lower rear right side of the engine, with a new gasket.

b. Connect fuel inlet, outlet and drain plumbing on the pump.

c. Install the fuel pump heat shield.

d. Close the right cowl door.

ENGINE DRIVEN FUEL PUMP ADJUSTMENT

a. The fuel pump is located at the rear, on the lower right side of the engine. Access is the right cowl door on each nacelle.

b. Install a fuel pressure gage (0-30 psi range) and a "T" fitting on the pressure side of the pump.

c. Break the safety wire and loosen the lock nut of the adjusting screw.

d. Disconnect and plug the air reference line from the engine pump.

NOTE

Allow the air reference line fitting on the fuel pump to remain open while adjusting the pressure on the pump.

e. Operate the engine at 2900 rpm and set the engine pump to 23 psi with the boost pump off.

f. Reinstall the air reference line to the pump.

g. Tighten the lock nut and safety wire.

FUEL SELECTOR VALVE REMOVAL

a. Drain the fuel system.

b. Place the aircraft on jacks and partially retract the gear until the inboard main gear door is fully extended.

c. Remove the selector control cable. (Refer to FUEL SELECTOR VALVE CONTROL CABLE REMOVAL).

d. Remove the fuel selector valve plumbing.

e. Remove the bolts securing the selector valve to the mounting bracket.

FUEL SELECTOR VALVE INSTALLATION

a. Position selector valve on the mounting bracket and install attaching bolts.

b. Lubricate threaded fittings with VV-P-236 petrolatum (Chart 208, 91-00-00).

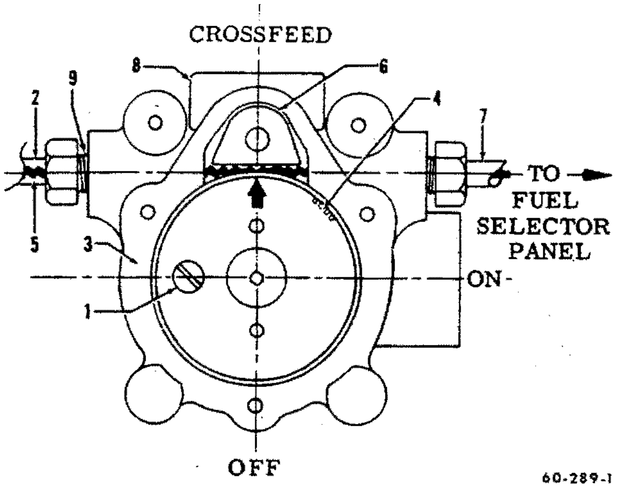
c. Connect the fuel selector plumbing.

d. Install the selector control cable. (Refer to FUEL SELECTOR VALVE CONTROL CABLE INSTALLATION.)

e. Rig the selector control cable. (Refer to FUEL SELECTOR VALVE CONTROL CABLE RIGGING.)

FUEL SELECTOR VALVE CONTROL CABLE REMOVAL
(Figure 201)

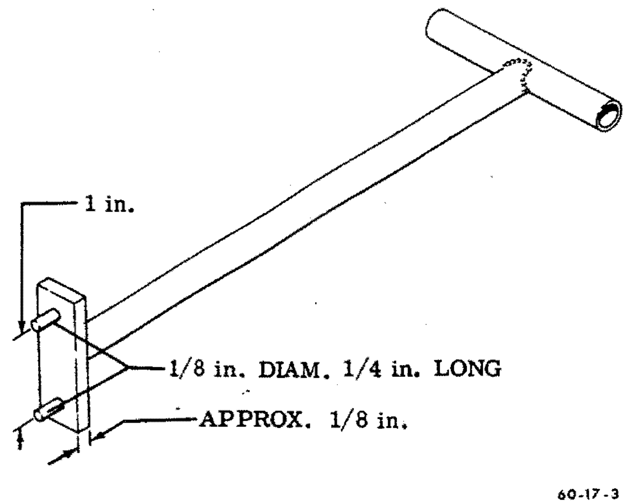
a. Remove the cover plate (not shown), stop screw (1) and overtravel tube (2) from the valve gearbox (3) located in the wheel well.



Fuel Selector Valve
(LH Shown, Cover Plate Removed)

1. Stop Screw
2. Over Travel Tube
3. Selector Valve Gearbox
4. Selector Gear
5. Control Cable
6. Slider
7. Cable Housing
8. Cross Feed Port
9. Over Travel Port

Fuel Selector Valve
Figure 201



Rigging Tool
Figure 202

b. The cable may be removed through the overtravel port by rotating the selector gear.

FUEL SELECTOR VALVE CONTROL CABLE INSTALLATION

Refer to FUEL SELECTOR VALVE CONTROL CABLE RIGGING for installation procedures.

FUEL SELECTOR VALVE CONTROL CABLE RIGGING

(Figure 201 and 202)

To aid in the rigging procedure, a locally manufactured "rigging tool" (see Figure 202) may be constructed for turning the selector gear. Tubing of 1/4 to 3/8 inch diameter is used for the handle and 1/8 inch steel pins are used for the protrusions which contact the selector gear.

a. Remove the cover plate (not shown), stop screw (1) and overtravel tube (2) from the fuel selector valve gearbox (3) located in the wheel well. (See Figure 201).

b. Using the rigging tool, set the selector gear (4) in the CROSSFEED position. The arrow on the selector gear should be positioned at 12 o'clock.

c. Set the selector handle pointer on the fuel selector panel 180° from the ON position and hold firmly in this position.

d. Insert the control cable (5) through the overtravel port and rotate the cable (LH thread) to engage two threads in the selector valve gear.

e. Rotate the selector gear 6-3/4 revolutions to feed the control cable through its housing up to the fuel selector panel gearbox in the pilot's compartment.

f. Screw the cable in (LH thread) until the cable end is 4.3 inches minimum to 4.5 inches maximum from the face of the overtravel port. It will be necessary to have someone hold the selector handle pointer in position until the control cable is engaged with the gears in the fuel selector panel.

g. Move the fuel selector handle pointer to the CROSSFEED position. The arrow on the selector gear should now be at the 12 o'clock position. The cable end should measure 2.7 inches minimum to 3.3 inches maximum from the overtravel port.

h. Install the stop screw and install and safety the overtravel tube. Place the selector handle in all positions to insure proper selection and operation.

i. Install and safety the cover plate. No lubricant is used on the fuel selector valve.

VENT FLOAT VALVE REMOVAL

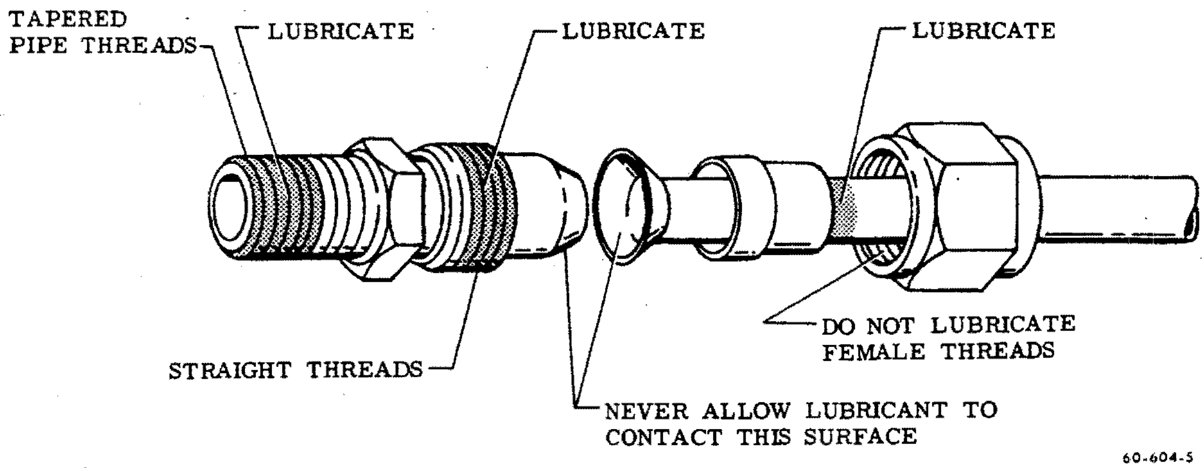
a. Remove the two access plates on the lower side of the wing tip.

b. Loosen the clamps and disconnect the three vent lines from the float valve.

c. Loosen the clamp securing the float valve in position.

NOTE

Mark the position of the float valve in the clamp. The float valve must be reinstalled in the same position to enable the float to function properly.



Lubrication of Flared Fittings
Figure 203

d. Remove the float valve from the clamp.

VENT FLOAT VALVE INSTALLATION

a. Position the float valve in the clamp in the same position as noted during removal. Torque the clamp to 25± 5 inch- pounds.

b. Connect the three vent lines to the float valve and torque the hose clamps to 25 ± 5 inch-pounds.

c. Install the two access plates on the lower side of the wing tip.

FLARED FITTINGS

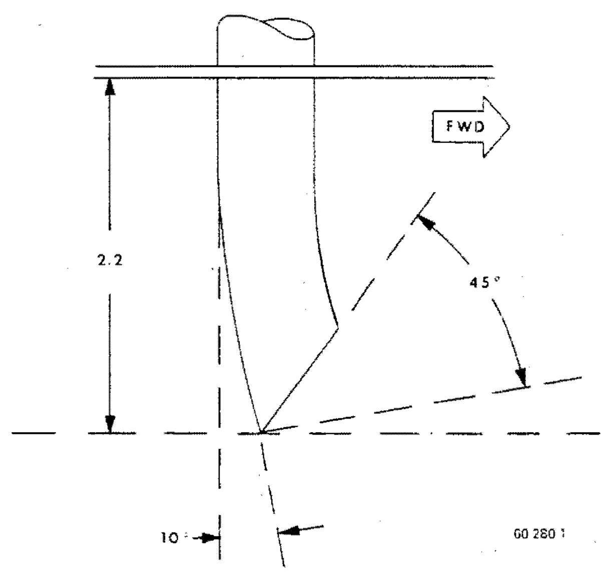
(Figue 203)

When installing flared fittings and hoses, make sure the threads are properly lubricated with VV-P-236 petrolatum (Chart 208, 91-00-00). When previously installed fittings are removed, they should be wiped clean and relubricated before they are reinstalled. Torque all fittings in accordance with (Chart 204, 91-00-00).

EXTERNAL FUEL CELL VENT LINE

(Figure 204)

The end of the fuel vent lines should extend 10 degrees forward from vertical for a distance of 2.2 inches below the lower surface of the wing. The end of the line is scarfed at a 45 degree angle facing forward to ensure a positive vent pressure, for any other configuration would create a negative pressure that would pull the air, or air and fuel from the fuel cell.



Fuel Vent Line
Figure 204

"END"

INDICATING - MAINTENANCE PRACTICES

FUEL QUANTITY INDICATORS

Fuel quantity is measured by float type transmitter units which transmit the common level indication to a single indicator for each respective wing. Two transmitters are located in each inboard leading edge wing cell, one outboard and one inboard. One transmitter is located in each nacelle fuel cell.

FUEL TRANSMITTER REMOVAL

a. Remove fuel cell access plate. (See Figure 201 or 202, 28-10-00.)
b. Disconnect electrical wire at the transmitter.
c. Remove the bolts attaching the fuel transmitter to the fuel cell.
d. Cover the open fuel cell port to prevent entry of foreign materials.

FUEL TRANSMITTER INSTALLATION

a. Remove the cover from the fuel cell port. Clean the surfaces of the fuel cell and transmitter.
b. Install the fuel transmitter with a new gasket. Torque the attaching bolts to 25 ± 5 inch-pounds and safety wire.
c. Connect the electrical wire to the transmitter.
d. Install the fuel cell access plate.

NOTE

On airplanes serials prior to P-186, when AC transmitters are removed for replacement, install Rochester transmitters. When this is done, the remaining transmitters in the applicable wing and the printed circuit board must be replaced.

ADJUSTING AND TESTING FUEL GAGING SYSTEM

An external power unit regulated at 28.25 VDC should be connected to the airplane when checking and adjusting the fuel gages for proper indication in the full and empty positions.

a. Remove the access plates covering the fuel quantity transmitters.
b. To check the fuel gage for full readings it is necessary to substitute a resistor for the three transmitters on each side. On airplanes equipped with AC transmitters, a 90 ohm resistor is required; on airplanes equipped with Rochester transmitters, a 270 ohm resistor is required. The resistor may be connected as follows:

1. Connect the resistor to wire E13A20 (at inboard leading edge transmitter) and to E11B20 (at nacelle transmitter) for the right wing system.

2. Connect the resistor to wire E17A20 (at inboard leading edge transmitter) and to E15B20 (at nacelle transmitter case) for the left wing system.

Actual fuel level for this test is irrevalent.

NOTE

A potentiometer, located on the printed circuit board behind each fuel quantity gage, may be adjusted to obtain a full reading on the gage.

c. The empty reading on the fuel gage may be checked by jumping a 20 gage wire between the inboard leading edge transmitter and the nacelle transmitter. Connect wire E13A20 to E11B20 (right wing) and E17A20 to E15B20 (left wing). Fuel level for this test is irrelevant.
d. To check the transmitters for the proper resistance in the empty position, it is necessary to defuel the airplane. If the fuel gages do not read empty, measure the resistance of the transmitters in series.

1. Connect the lead of an ohmeter to the number 2 terminal of the inboard leading edge transmitter and the other lead to the number one terminal on the nacelle transmitter (right wing).
2. Connect the lead of an ohmeter to the number 2 terminal of the inboard leading edge transmitter and the other lead to the case terminal of the nacelle transmitter (left wing).

The total resistance for each side should be 0 to 0.5 ohms. If the total resistance is excessive, check each transmitter and/or associated wiring for the cause of high resistance.

e. To check the transmitters for the proper resistance in the full position, visually check to determine all tanks are full. If the fuel gage does not give a full indication, check the resistance total for each wing as in the preceding step.
f. With AC transmitters installed, the total resistance should be 90 ohms per wing; individual transmitters should register 30 ± 2 ohms. With Rochester transmitters installed, the total resistance should be 270 ohms per wing; individual transmitters should register 90 ± 2 ohms.
g. Replace the access covers.

FUEL FLOW INDICATOR

For fuel flow indicator refer to Chapter 73.

FUEL SIGHT GAGE (P-402 and after)

For conveniance during fueling operations there is a fuel sight gage installed in each wing. The gage is installed in the upper leading edge just outboard of each nacelle. The gage is of the mechanical float type and the indicated fuel quantity is in U.S. gallons.

FUEL SIGHT GAGE REMOVAL (P-402 and after)

a. Remove the screws in the access plate and remove the plate.

b. Remove the screws around the sight gage and remove the gage.

FUEL SIGHT GAGE INSTALLATION (P-402 and after)

a. Position the gasket and gage in place (the gage will fit only one way).

b. Install the attachment screws and torque to 25 inch-pounds.

c. Safety wire the attachment screws.

d. Install the access cover plate and secure with screws.

"END"

CHAPTER 30

LIST OF PAGE EFFECTIVITY

"END"

CHAPTER 30 - ICE AND RAIN PROTECTION

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CHAPTER 30 - ICE AND RAIN PROTECTION

TABLE OF CONTENTS (Cont'd)

"END"

GENERAL - DESCRIPTION AND OPERATION

The Duke 60 series aircraft utilizes heated pitot, heated stall warning, and heated fuel vents for standard ice protection equipment. Optional icing equipment includes: pneumatically operated surface deice boots and electrically heated propellers, heated windshield and heated ventilation ram air inlet scoop. In addition, an alternate static air source backs up the fuselage mounted static air source buttons.

"END"

AIRFOIL - DESCRIPTION AND OPERATION (Figure 1)

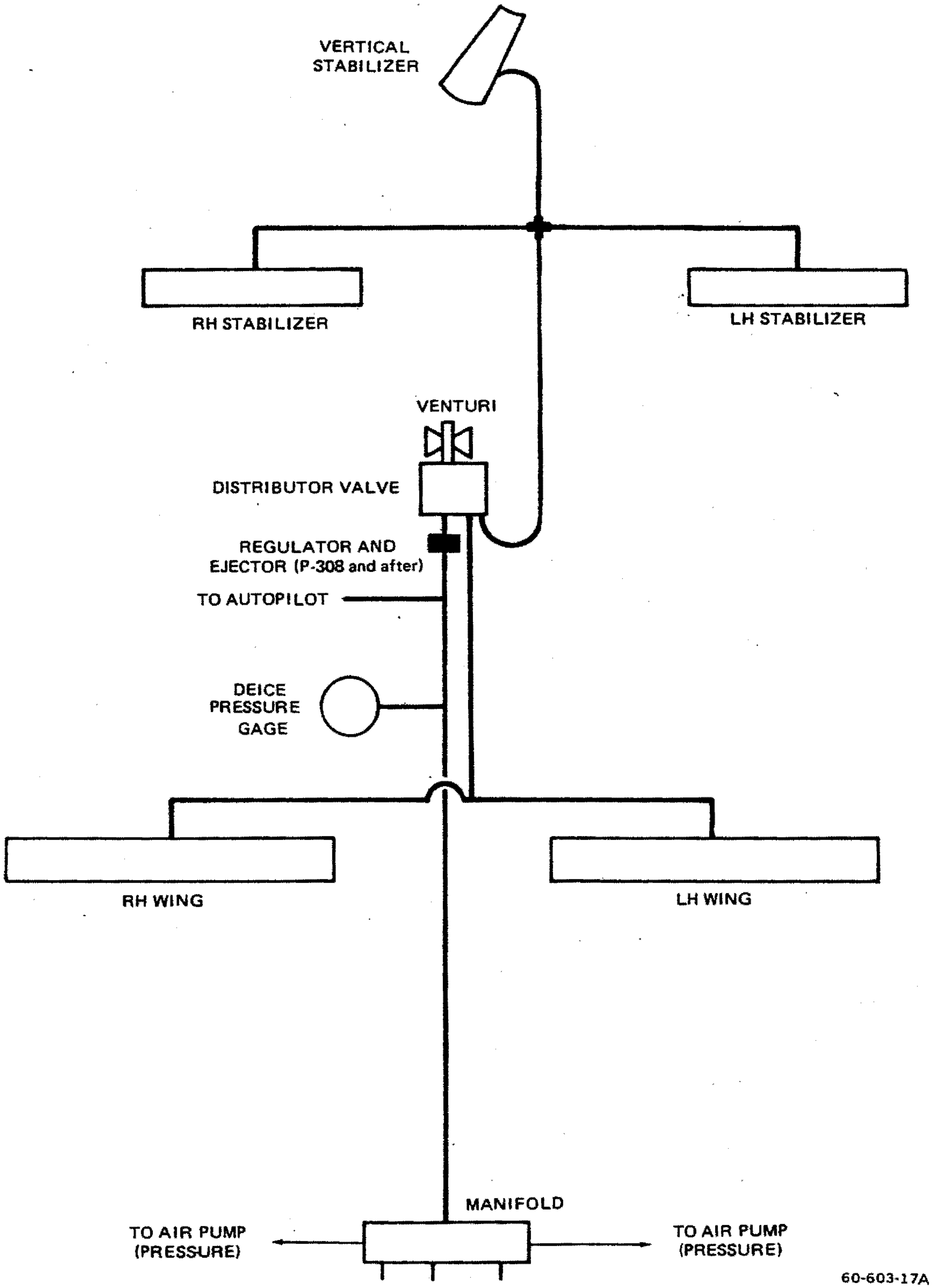
Deice boots on the wing and empennage leading edges are inflated by the two engine-driven pressure pumps. A venturi, operated from the pressure pumps, supplies vacuum for boot hold down at all times except during the inflation mode. Through an electric timer, solenoid-operated control valves cause all the boots to be inflated simultaneously. The timer is controlled by a three-position switch: SURFACE ONE CYCLE, and MANUAL with OFF position centered. This switch is located on the left subpanel. ONE CYCLE and MANUAL switch positions are momentary. A gage is provided to indicate system pressure. Momentary engagement of the ONE CYCLE position will cause the boots to inflate for five to eight seconds, then deflate to the vacuum hold-down condition. The MANUAL position will inflate the boots only as long as the switch is held in engagement; when the switch is released, the boots deflate. Leave the deicing system off until 1/2 to 1 inch of ice is accumulated. During inflation, the deice system pressure gage should register approximately 15 to 18 psi. Sufficient pressure for proper operation of the system is available with one engine inoperative.

On airplane serials P-3 through P-307, when the surface deice system is operated with the cabin pressure switch in the DUMP position, cabin pressure oscillations will occur. This is caused by a momentary loss of vacuum to the outflow valve while the boots are pressurizing. This vacuum loss allows the outflow valve to close and create a small residual cabin pressure. After a small increase, this pressure is then dumped by the safety valve.

The cabin pressurization shut off controls should be pulled during this mode to divert cabin pressurizing air overboard and prevent excessive cabin pressure oscillations. Cabin ventilation may be obtained by pulling out the cabin air control. In this mode pressure oscillations will be small.

On airplane serials P-308 and after, the vacuum used by the cabin pressurization system is developed in an ejector installed in the supply line for the deice distribution valve. Thus, operation of the deice system does not cause fluctuations of cabin pressurization.

For night operation, a wing ice light is provided on the outboard side of the left nacelle. The switch, placarded WING ICE, is on the left subpanel.



Airfoil Deice System Schematic
Figure 1

"END"

TROUBLESHOOTING
AIRFOIL DEICER SYSTEM

The following troubleshooting procedures are based on the assumption that the engine-driven dry air pumps are operational.

	TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1.	Deicer boots do not inflate (either or both engines operating at a minimum cruise RPM for a period of eight seconds).	a. Open circuit breaker.	a. Push deicer circuit breaker to reset.
		b. Loose electrical connection or broken wire.	b. Tighten or repair as required.
		c. Time delay relay not functioning.	c. Replace time delay relay.
		d. Control relay not functioning	d. Replace control relay.
		e. Deicer boot punctured.	e. Repair as described in this chapter or replace.
		f. Distributor valve not functioning.	f. See steps 4 and 5.
		g. Piping lines kinked, blocked, or not connected.	g. Inspect and repair or replace as required.
		h. Leak in system.	h. Locate and repair.
2.	Deicer boots inflate too slowly (either or both engine operating at minimum cruise RPM for a period of eight seconds)	a. Piping lines kinked, partially blocked, or not securely connected.	a. Inspect and repair or replace as required.
		b. Leak in system.	b. Locate and repair.
		c. Deicer boot punctured.	c. Repair as described in this chapter or replace.
		d. Distributor valve not functioning.	d. See steps 4 and 5.
3.	Deicer boots deflate too slowly.	a. Piping lines kinked, partially blocked, or not securely connected.	a. Inspect and repair or replace as required.
		b. Overboard line from distributor valve partially blocked.	b. Inspect and repair or replace as required.
		c. Distributor valve not operating properly.	c. Overhaul or replace.
		d. Electrical circuit malfunctioning.	d. See Wiring Diagram Manual, P/N 60-590001-29.
		e. Vacuum ejector on distributor valve plugged.	e. Remove obstruction or replace.

TROUBLESHOOTING
AIRFOIL DEICER SYSTEM (Cont'd)

NOTE

The following items might aid in ascertaining whether or not the distributor valve is functioning properly.

TROUBLE	PROBABLE CAUSE	REMARKS
4. One or more boots do not inflate -- with pressure gage at normal reading with switch held in MANUAL or momentarily placed in SINGLE position.	a. Defective wiring in external circuit or other units.	a. See Wiring Diagram Manual P/N 60-590001-29 and disconnect plug at distributor valve. Voltage should be approximately 28 VDC between A-C and B-C. Make sure C is well grounded. On airplane P-390 and after, voltage should cycle at approximately 28 VDC between the blue-white wires. Make sure the white wire is well grounded
	b. Faulty solenoids in distributor valve.	b. Measure resistance of solenoids. Reading should be 17.5 ohms + 5% through the receptacle pins A-C and B-C. On airplanes P-390 and after reading should be 127 ohms ± 5% between the blue-white wires. Replace the distributor valve if readings do not check.
	c. Mechanical failure in distributor valve.	c. Disconnect lines at the outlet ports of the distributor valve and check valve operation with a gage. If trouble is not found in the distributor valve, inspect boots and lines for leaks or blockage.
	d. Piping lines kinked, blocked, or not connected.	d. Inspect and repair or replace as required.
5. One or more boots inflate but do not deflate readily -- with pressure gage at normal reading.	a. Defective boots.	a. Repair as described in this chapter or replace.
	b. Obstruction of lines.	b. Disconnect line from exhaust port of distributor valve and see if line is clear to low pressure area.
	c. Mechanical failure in distributor valve.	c. With line disconnected, see if exhaust port is discharging; if not replace distributor valve.

"END"

AIRFOIL DEICER - MAINTENANCE PRACTICES

SERVICING

Since the deicer boots and related components operate on clean air supplied from the pressure manifold, little is required in the form of servicing the system. The boots should be checked for engine oil after servicing and at the end of each flight, and any oil found should be removed. This can be accomplished by the use of a neutral soap and water solution. Care should be exercised to avoid scrubbing the surface of the boot as this will tend to remove the special conductive surfacing.

NOTE

Because the deicer boots are made of soft flexible stock, care must be exercised against dragging gasoline hoses over them or resting ladders or platforms against the surface of the boots.

SURFACE DEICER BOOT REMOVAL

To loosen or remove an installed deicer boot, use toluol (22, Chart 207, 91-00-00) to soften the "adhesion" line where the boot is joined to the metal surface. The solvent should be applied sparingly with a brush or trigger type oil can with a spout. Slowly peel the boot back, allowing the solvent time to undercut the boot. Exercise care not to injure the boot during removal.

SURFACE DEICER BOOT INSTALLATION

PREPARATION OF METAL SURFACES

Solvent Cleaning: The metal surface should be completely clean to prevent adhesion failure. Using a grease-free cloth dampened in MIL-M-13999 methyl ethyl ketone, (21, Chart 207, 91-00-00) go over the area to be covered by the boot. Change the cloths frequently, to avoid contaminating a previously cleaned area. Do not contaminate the clean supply of methyl ethyl ketone, by dipping a used cloth into it. Repeat the process. Using a clean, damp cloth and a clean dry cloth, go over the area again; use the dry cloth (following the damp cloth) to wipe the surface dry, rather than letting it air dry.

Chemical Cleaning: Follow the solvent cleaning, with a grease-free cloth wetted with an acid cleaner (41, Chart 207, 91-00-00). Vigorously scrub surface.

CAUTION

Although the acid cleaner is a mild acid solution, protective rubber gloves should be worn and contact with the skin should be avoided.

After the acid cleaner has had one minute's contact, wipe dry with a clean cloth. Allow a minimum of one hour dry-time before applying cement. At the end of the dry-time, wipe the surface with a clean cloth and inspect the cloth for dirt. If dirt is present, reclean with methyl ethyl ketone; if not, cover the clean surface with paper until the cementing operations are begun.

PREPARATION OF RUBBER SURFACES

If the deicer boot has a smooth back finish, roughen it slightly with sandpaper before beginning the cleaning operation. Wet a clean cloth with toluol (22, Chart 207, 91-00-00) and carefully clean the rough back surface of the boot. Change cloths frequently to avoid contamination of the cleaned areas. Clean the boot a minimum of two times; if the area still seems dirty, reclean the surface in the same manner.

Application of Adhesive: The drying of the cement is a function of time and temperature, and the table below should be used as a shop guide when applying the cement:

Temperature - °F	Minutes of Dry Time
Above 80	30
60-80	45
Below 60	60

Do not apply cement under dusty conditions or in high humidity (80% relative humidity or above). Prior to cementing, mask off the boot area on the metal surfaces, allowing 1/2 to 3/4 inch margin.

SPRAY COAT METHOD:

If the EC-1300L adhesive (12, Chart 205, 91-00-00) is applied by spray, the first coat on the back surface of the boot and on the metal surface should dry a minimum of 30 minutes. The second cross coat on each surface should be allowed to dry a minimum of 30 minutes, preferably one hour.

BRUSH COAT METHOD:

Apply an even brush coat of EC-1300L adhesive (12, Chart 205, 91-00-00) to the back surface of the boot and the metal surface of the airplane. Allow a minimum of 30 minutes to dry. Apply a second coat to each surface in a smooth, even layer. Brushing in one area too long tends to soften the first coat and "rolling" and "balling up" will result. Allow the coating to thoroughly dry a minimum of 30 minutes, preferably one hour before installation. Excess drying time (not to exceed 7 days) is not critical as long as the surfaces are not contaminated.

INSTALLATION OF THE BOOT

Using a chalk line, snap a line centrally located on the leading edge of the surface. Snap a line, centrally located cordwise, on the cemented side of the boot.

Securely attach hoses to the deicer connection, being careful to handle the boot section without getting finger marks on the adhesive. Using a lint-free cloth, heavily moistened (not dripping) with toluol, (22, Chart 207, 91-00-00) reactivate the surface of the leading edge and boot about 3 inches on either side of the chalk line. Position the boot chalk line directly on the leading edge chalk line and hand roll the boot surface onto the leading edge. Moving along the center line of the leading edge, continue reactivating the adhesive in strips 6 inches wide by 24 inches long. Avoid excessive rubbing of the adhesive surface as some of the adhesive may be removed. Hand roll the joined surfaces to ensure complete contact of the adhesive and elimination of air pockets. If the boot does not follow the chalk line on the leading edge, pull it up immediately with a quick motion and reposition properly. Now complete the installation by activating the adhesive surfaces and rolling on the top and lower half of the boot in sequence. Finally roll the entire boot (applying pressure) moving in a direction parallel with the inflatable tubes. Use a narrow stitch roller between tubes to eliminate air entrapment. If an air pocket or blister is noted immediately after boot installation, the air may be removed by inserting a hypodermic needle into the blister and allowing the air to escape. The surfaces may then be pressed down, permitting the surfaces to adhere.

NOTE

When removing entrapped air from the boot by use of a needle, be extremely careful not to puncture one of the inflatable tubes.

SEALING EDGES

Fair in all around cut edges and trailing edges of the boot with EC-801 sealer (11, Chart 205, 91-00-00) and cover all exposed adhesive. Never try to remove excess adhesive closer than 1/4 inch from the boot edge. After all adhesives and sealing compounds have dried and cured, remove masking tape and clean adjacent areas with solvent.

STALL STRIP INSTALLATION (RUBBER)

(Figure 201)

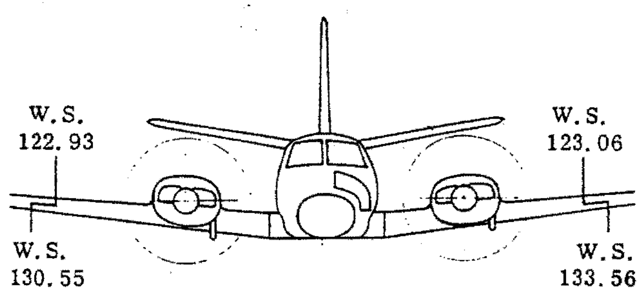
a. The stall strips are 7.62 inches long for the right wing and 10.50 inches long for the left. The right stall strip is installed with its inboard end at Wing Station 122.93 and the left stall strip is installed with its inboard end at Wing Station 123.06.

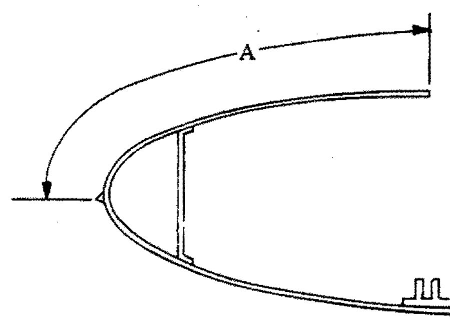
b. Clean boot surface thoroughly, removing all old cement. Mask off the area where the new strip is to be installed and wipe with MIL-M-13999 methyl ethyl ketone (21, Chart 207, 91-00-00).

c. Bostic 1008, a two part cement, (18, Chart 205, 91-00-00) is used to join the stall strip to the deicer boot. Mix the Bostic 1008 in the following manner: 30 parts (by weight) of the base material (in the "A" package) with 1 part (by weight) of the accelerator (in the "B" package).

d. Apply a coat to both the stall strip and the area to which it will be bonded. Allow to dry 10 to 15 minutes, then install the strip as shown in the illustration. The cement will set in about 6 hours.

e. When dry, coat the area with A56B cement (1, Chart 205, 91-00-00) to replace the conductivity of the boot.





60-34-1

Right Wing	Left Wing
Dimension "A" is 15.69 at Wing Station 122.93 and 15.06 at Wing Station 130.55.	Dimension "A" is 15.69 at Wing Station 123.06 and 15.00 at Wing Station 133.56.

Stall Strip Installation
Figure 201

RESURFACING DEICER BOOTS

Static electric charges, if allowed to accumulate, would eventually discharge through the boot to the metal skin beneath, causing static interference with radio equipment and possibly puncturing the rubber. Also, such static changes are a temporary fire hazard after each flight. To dissipate static electric charges, a thin coating of conductive cement is applied over the neoprene of the boot. From time to time it may be necessary to restore the conductivity to efficiently dissipate such charges. When resurfacing seems advisable, the principal factors involved are:

a. If the surfacing material has abraded.
b. If the surfacing has developed cracks.
c. If the conductivity is low.

The following procedures should be accomplished when resurfacing deicer boots.

a. Clean the deicer boots thoroughly with toluol (22, Chart 207, 91-00-00).
b. Roughen the entire surface of the boot with fine sandpaper.
c. Clean the surface again with a clean lint-free cloth moistened with toluol.
d. Apply masking tape beyond the upper and lower trailing edges, leaving a 1/4 inch gap of bare metal.
e. Brush one coat of Goodrich A56B cement (1, Chart 205, 91-00-00) on the boot and allow it to dry at least one hour. Then apply a second coat and allow it to dry at least four hours before operating the deicers. The airplane may be flown as soon as the cement is dry.

NOTE

If A56B cement has aged three months or more, it may be necessary to dilute it with toluol to obtain the proper brushing consistency. Mix thoroughly, approximately five parts cement to one part toluol.

ADJUSTMENT

Adjustment of the pneumatic pressure system is performed by adjusting the various regulators in a specified sequence. A PRESSURIZATION SYSTEM ADJUSTMENT CHART corresponding to applicable illustrations and a general adjustment procedure for each individual regulator are provided in Chapter 36-00-00.

COMPONENT LOCATION

TIME DELAY RELAY

The time delay relay is located forward of the instrument panel in the upper LH corner of the forward pressure bulkhead.

CONTROL RELAY

The control relay is located forward of the instrument panel in the upper LH corner of the forward pressure bulkhead.

DISTRIBUTOR VALVE

The distributor valve is located just forward of the access opening on the RH side of the aft fuselage. The distributor valve is accessible, for removal and installation, through the access openings on the lower aft fuselage and the RH side of the aft fuselage. The valve may be removed by disconnecting the hoses and removing the attaching screws.

COMPONENT REPLACEMENT

No maintenance on these components is recommended. Repair or replacement of parts should be made through the Beech Aircraft Corporation overhaul, and exchange program.

"END"

AIR INTAKES - DESCRIPTION AND OPERATION

The possibility of induction system icing is reduced by the non-icing characteristics of fuel injection engines and is backed up by an automatic alternate air source. Should the ram air scoop or filter become clogged with ice, a spring-loaded door on the firewall will open automatically, and the induction system will operate on alternate air. When operating on alternate air above the critical altitude, approximately 8 to 10 inches of manifold pressure will be lost.

On airplanes P-3 thru P-266, an optional equipment ram air inlet electrothermal lip boot is utilized. The boot is activated by a separate switch placarded RAM AIR INLET-OFF.

"END"

PITOT AND STATIC - DESCRIPTION AND OPERATION

A heating element in the pitot mast prevents the pitot opening from becoming clogged with ice. The heating element is connected into the aircraft electrical system through a 5-ampere circuit breaker.

"END"

WINDOWS AND WINDSHIELD - DESCRIPTION AND OPERATION

The pilot's and copilot's windshields are electrically heated to protect against icing. An inverter, also used as a standby for the avionics inverter, is installed for the operation of the pilot's windshield heat and is activated by a switch on the pilot's subpanel marked L WSHLD - OFF. The copilot's windshield is activated by a switch on the pilot's subpanel marked R WSHLD - OFF - L WSHLD. Each switch is protected by a 3/4-ampere circuit breaker located on the right subpanel. The 45-ampere circuit breaker that protects the other components of the system is located between the two LH bus isolation circuit breakers in the LH nacelle electrical equipment compartment. For equipment requiring AC current, a three position switch marked MN INV - OFF - STBY INV must be placed in the MN INV position. Should a failure occur in the main inverter, the switch can be placed in the STBY INV position. This opens a relay to direct the current from the windshield heat inverter to the avionics provided the L WSHLD switch is on. Power for the operation of both systems cannot be supplied by this inverter at the same time.

On airplane serials P-459 and after and prior airplane serials with Kit No. 60-3008-1S installed, a windshield voltage indicator is provided on the instrument panel which enables the operator and/or maintenance to monitor the voltage from the inverter to the windshield heater.

In operation a sensing element installed in the windshield sends a signal to the temperature control box located on the aft side of the forward pressure bulkhead at the base of the pilot's windshield, closing a relay permitting current to flow through the heating elements. The control box is factory adjusted between 90°F and 110°F to maintain the desired mean temperature. The control box operates in an ambient temperature range of −65°F to 160°F.

"END"

TROUBLESHOOTING
WINDOWS AND WINDSHIELD DEICER SYSTEM

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Windshield fails to heat.	a. Circuit breaker on RH subpanel tripped.	a. If circuit breaker persists in tripping, check for short and correct.
	b. Switch faulty.	b. If no voltage at switch output with correct voltage at switch input, replace switch.
	c. No input or output voltage to inverter circuit breaker.	c. Check for short and correct.
	d. Sensing element faulty.	d. Check for circuit continuity and replace windshield.
	e. No AC output voltage from control relay.	e. Check control relay, sensing element and control box and replace as required.
	f. Damaged heater circuit.	f. Replace windshield.

"END"

WINDOWS AND WINDSHIELD - MAINTENANCE PRACTICES

ELECTRICALLY HEATED WINDSHIELD RESISTANCE CHECK

To check for incorrect resistance or the presence of a short or open circuit in the heating elements of the windshield, the following procedure may be used:

a. With the windshield deicing system turned OFF, disconnect the leads to the heating element at the lower end of each bus.
b. Using an ohmmeter, determine the resistance of the heating element by placing the leads of the ohmmeter across the heating element leads. The resistance should measure 97.0 ± 9.7 ohms.
c. Reconnect the leads of the heating element.

SENSING ELEMENT RESISTANCE CHECK (Figure 201)

The resistance of the sensing element of the windshield varies with temperature changes. Figure 201 provides the acceptable range of resistance values at various ambient temperatures. The resistance of the sensing element may be checked as follows:

a. With the windshield deicing system turned OFF, disconnect the wire connected to one of the terminals of the sensing element.
b. Use an ohmmeter to determine the resistance of the sensing element.
c. Determine the temperature of the windshield.
d. Determine if the resistance measured falls within the tolerance shown in Figure 201.
e. Reconnect the windshield sensing element wire.

ELECTRICALLY HEATED WINDSHIELD VOLTAGE CHECK

CAUTION

Ground use of windshield heat is limited to 10 minutes.

a. Connect a precision voltmeter between the windshield heater control switch and the windshield heater.
b. Start the engines in accordance with the applicable Pilot's Operating Manual.
c. Set propeller speed at 1200 to 1500 rpm.
d. Turn the LH windshield switch ON. Note the increase on the voltmeter (minimum reading of 220 vac). A voltmeter reading of less than 220 vac indicates a malfunction of windshield heat.
e. Repeat steps "a" through "d" with the RH windshield heat switch ON.
f. Shut-down airplane engines in accordance with the applicable Pilot's Operating Manual.
g. Remove voltmeter from the airplane and restore wiring to the windshield heater circuit.

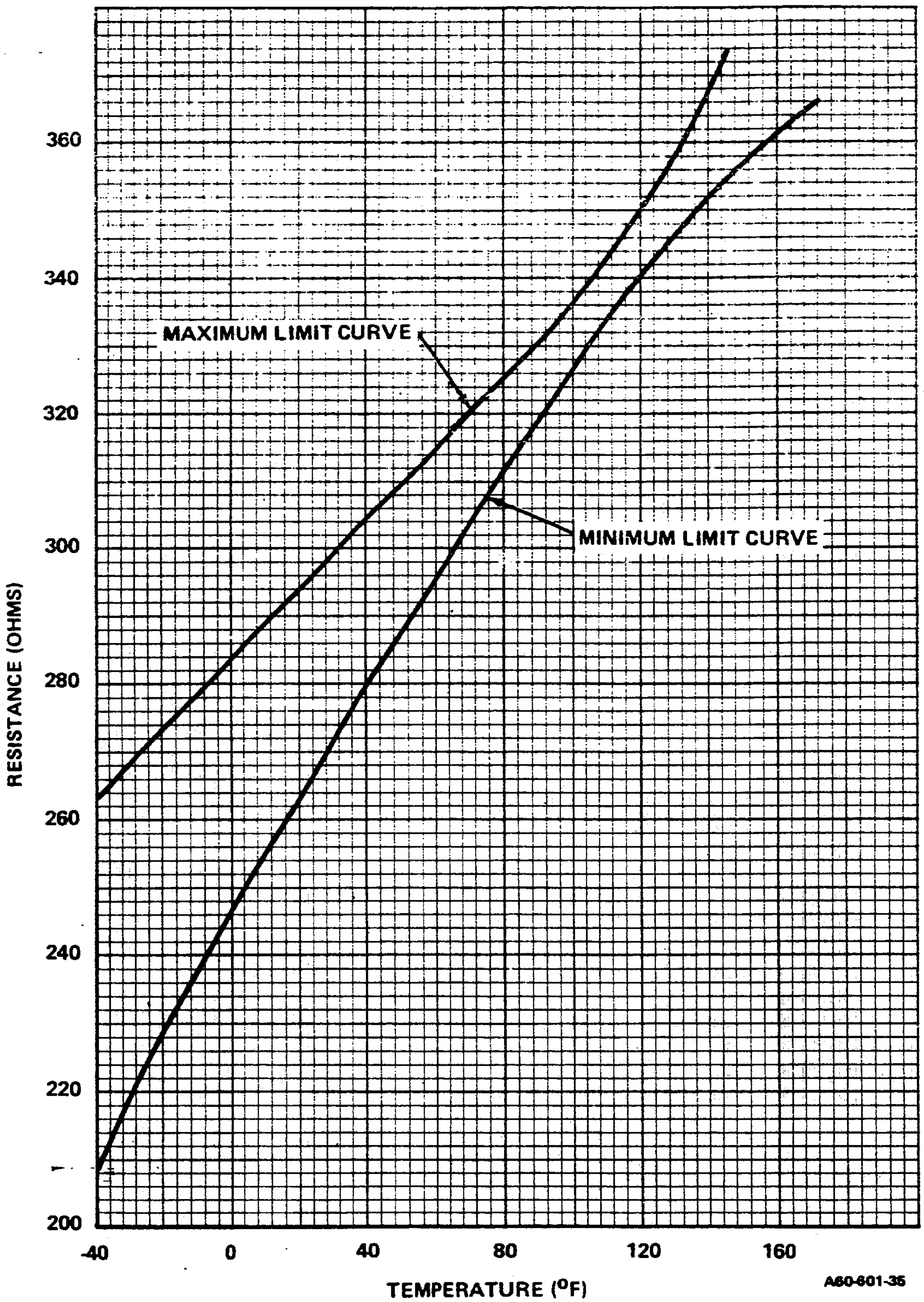
ELECTRICALLY HEATED WINDSHIELD FUNCTIONAL TEST

After completing the preceeding resistance checks, determine that the ambient temperature is 90° or less and perform the following functional check:

CAUTION

Ground use of windshield heat is limited to 10 minutes to prevent damage to the inverter.

a. Place the windshield DEICE control switch in the L WSHLD position.
b. Determine that the windshield should immediately begin to heat. Presence of heat may be determined by holding the hand against the heated portion of the windshield.
c. Place the windshield DEICE control switch in the OFF position.



Sensing Element Resistance Graph
Figure 201

"END"

PROPELLERS - DESCRIPTION AND OPERATION

ELECTRIC PROPELLER DEICING (Prior to P-579, FIGURE 1)

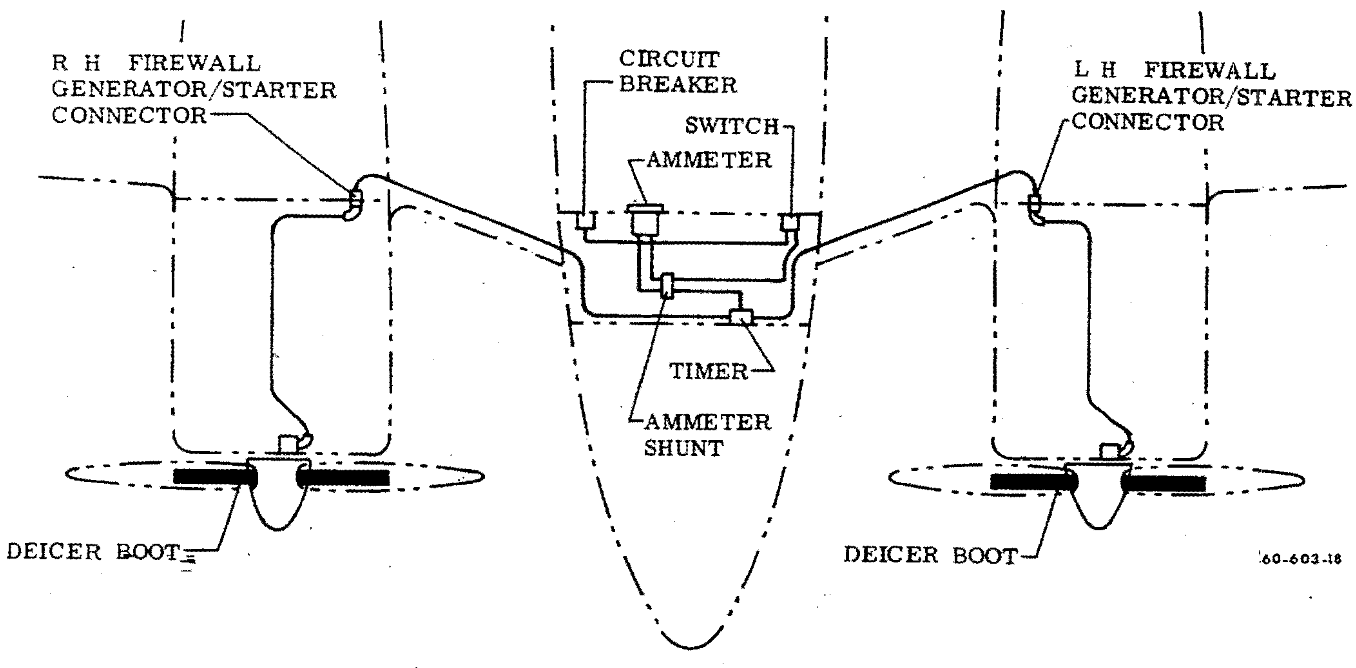
The electric propeller deicer system includes an electrically heated boot for each propeller blade, brush assemblies, slip rings, an ammeter, a control switch and a circuit breaker. When the switch is turned on, the ammeter registers the amount of current (14 to 18 amps) passing through the system. If a short develops in the system the circuit breaker will cut off the power to the timer. The current flows from the timer to the brush assembly mounted on the front of the engine case and is conducted by the brush assembly to the slip rings installed on the starter ring gear. The slip rings distribute current to the deicer boots on the propeller blades. Heat from the boots reduces the grip of the ice, which is then removed by the centrifugal effect of propeller rotation and the blast of the airstream. Power to the two heating elements on each blade is cycled by the timer to the outboard and inboard heating elements in the following sequence: RH outboard, RH inboard, LH outboard, LH inboard. Since each of these phases is 30 seconds in duration, the timer makes a complete cycle every two minutes. Whenever the timer switches to the next phase of operation, the ammeter will register a momentary deflection.

ELECTRIC PROPELLER DEICING (P-579 and after)

On airplanes P-579 and after, the electrothermal deice boots mounted on the propeller blades are electrically heated. Direct current for deice boot heating is supplied through a system of controls by two brushes which ride on dual slip rings mounted on the propeller assembly.

The brushes used on this installation are of the modular block type. The dual slip rings are supplied as an assembly. Maintenance of the modular brush blocks and slip ring assemblies are covered elsewhere in this chapter under respective headings.

Current for operation of the deice timing control and the deice boots is supplied through a switch, located on the pilot's LH subpanel, and a 20-ampere circuit breaker. When the switch is placed in the ON position, the deice timer begins to run, initiating automatic cycling of electrical power to the deice boots. At intervals of approximately 90 seconds in duration, the timer alternately cycles power to the LH then RH propeller deice boots. Current for operation of the deice system is indicated by an ammeter located on the RH instrument panel.



Propeller Deicer System
Figure 1

"END"

PROPELLERS - TROUBLESHOOTING

The ammeter of the deicer system can be used to indicate the general nature of most electrical problems. Consequently, it is recommended that troubleshooting be preceded by the ammeter test as outlined under ELECTRIC PROPELLER DEICER in Chapter 5-20-00 of this manual, and the HEAT TEST described in this chapter to determine which circuits are involved. A reading of two-thirds the normal amount of current is an indication that one of the circuits is open between the slip ring and deicer heater. If the ammeter registers excess current, the power lead is shorted to ground. It may be possible that the excess current has welded the timer contacts in one phase. Under these circumstances, the timer will either feed current to the welded contacts continuously or will not cycle. If the former is true, the heat test will show two phases heating simultaneously throughout three of the four phases. Unless the grounded power lead is located and corrected, any new timer that is installed may suffer the same internal damage during the first use of the system.

TROUBLESHOOTING
PROPELLER DEICING SYSTEM (PRIOR TO P-579)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Ammeter shows zero current. (All 4 phases of the 2-minute 16-second cycle.)	a. Circuit breaker tripped.	a. Locate and correct short before resetting circuit breaker.
	b. Switch faulty.	b. If no voltage at switch output with voltage at switch input, replace the switch. If voltage is OK at switch output, go to step "d".
	c. No power from aircraft.	c. If no voltage into switch, locate and correct open circuit.
	d. Ammeter faulty. (If some or all deicers heat with ammeter at zero, replace the ammeter.)	d. Test for voltage up to and out of ammeter. If low or zero output but proper input, replace ammeter. If no voltage to ammeter, locate and fix open between switch and ammeter.
	e. Open circuit between ammeter and timer.	e. Disconnect harness at timer and check voltage pin B (of harness) to ground. If none, locate and correct open circuit.
2. Ammeter shows normal current part of cycle, zero current rest of cycle.	a. Open in wiring between timer and firewall connector.	a. Refer to HEAT TEST in this chapter to find deicers not heating and test for voltage on that pin of firewall connector. If zero over 2 minutes, locate and fix open in wiring from timer to firewall.
	b. Open between firewall and deicer lead straps.	b. If voltage to firewall plug, try voltage at junction of deicer lead and slip ring lead. If no voltage, find and correct open in wiring to brush block, open within brush block, or no contact brush to slip ring.
	c. No ground circuit, one engine.	c. If voltage at deicer leads, locate and fix open from deicer to ground.
3. Ammeter shows normal current part of cycle, low current rest of cycle.	a. Inner and outer deicers heating same phase.	a. Locate and repair incorrect connections.

TROUBLESHOOTING
PROPELLER DEICING SYSTEM (Cont'd)
(PRIOR TO P-579)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
	b. Open in deicer or slip ring assembly.	b. Disconnect deicer straps to check heate resistance. If resistance is within specifie limits, locate and fix open in slip rin leads. If not, replace deicer with oper circuit.
	c. High resistance in circuit with low current.	c. If not in contact of brush to slip rin (including ground brush), trace wiring t deicer and to timer to fix partially broker wire, loose or corroded connection.
4. Ammeter shows low current over entire cycle.	a. Aircraft voltage low.	a. Check voltage into switch.
	b. Ammeter faulty.	b. Refer to step "1d".
	c. High resistance up to timer.	c. Check for partially broken wire, loose o corroded connection in wiring from aircra supply to timer input.
5. Ammeter shows excess current over entire cycle.	a. Ammeter faulty.	a. Refer to step "1d".
	b. Ground between ammeter and timer.	b. Disconnect harness at timer and, wit ohmmeter, check from pin B (of harness to ground. If ground is indicated, locat and correct.
6. Ammeter shows normal current part of cycle, excess current rest of cycle.	a. Ground between timer and brush block.	a. Disconnect leads at brush block an check from power leads to ground wit ohmmeter. If ground is indicated, locat and correct.
	b. Ground between brush block and deicers. (Excluding ground brush circuit.)	b. If no short exists at brush-slip rin contact, check for ground from slip rin lead to bare prop while flexing slip rin and deicer leads. If a ground is indicatec locate and correct.
	c. Short between two adjacent circuits.	c. Check for shorts or low resistanc between circuits, if any, locate an correct.
	d. Timer faulty.	d. Test timer as indicated in DEICER TIME CHECK in this chapter.
7. Ammeter does not "flick" each 34 seconds.	a. Timer ground open.	a. Disconnect harness at timer check wit ohmmeter from pin G (of harness) t ground. If no circuit, refer to Wirin Diagram Manual (P/N 60-590001-29) t fix open circuit.

TROUBLESHOOTING
PROPELLER DEICING SYSTEM (Cont'd)
(PRIOR TO P-579)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
	b. Timer contacts are welded (caused by short circuit in system).	b. Test timer as in DEICER TIMER CHECK in this chapter. If timer does not cycle with voltage at pin B, replace timer but be sure short causing original problem has been located and corrected.
8. Ammeter flicks between 34 second phase periods.	a. Loose connection between aircraft power supply and timer input.	a. If trouble occurs over entire cycle, trace wiring from power source to timer input to locate and tighten loose connection.
	b. Loose or poor connection timer to deicers.	b. If trouble occurs in part of cycle, find which deicers are affected and check for rough to dirty slip rings causing brush to "skip". If not this, trace circuits to locate and fix loose or poor connection. (If all deicers on one prop are affected, check the ground circuit.)
	c. Timer cycles erratically.	c. Test timer as indicated in DEICER TIMER CHECK in this chapter.
9. Radio noise or interference with deicers on.	a. Brushes "arcing".	a. Check brush alignment as outlined under ELECTRICAL PROPELLER DEICER in Chapter 5-20-00 of this manual. Look for rough or dirty slip rings. If this is the cause, clean, machine or replace slip ring assembly. Check for slip ring alignment.
	b. Loose connection.	b. Refer to step 8 above.
	c. Switch faulty.	c. Try jumper wire across switch. If radio noise disappears, replace the switch.
	d. Wiring located less than 8 inches from radio equipment wiring.	d. Replace at least 8 inches from input wiring to radio equipment.
10. Cycling sequence not correct.	a. Crossed connections.	a. Check Wiring Diagram Manual (P/N 60-590001-29) for improper connections.
11. Rapid brush wear or frequent breakage.	a. Brush block out of alignment.	a. Check brush alignment as outlined under ELECTRIC PROPELLER DEICER in Chapter 5-20-00 of this manual.
	b. Slip ring wobbles.	b. Check slip ring alignment with dial indicator.

"END"

TROUBLESHOOTING ELECTROTHERMAL PROPELLER DEICE SYSTEM (P-579 and After)

Propeller deice ammeter reading outside the shaded area of the meter (14-18 amperes) is an indication that a fault may exist in the deice system. It should be noted, however, that current readings above or below the shaded areas of the deice ammeter may indicate an output voltage outside the normal operating range (28.25 ± .25 vdc) rather than a defect in the deice system itself. Excessively high operating voltage could conceivably damage the deice system and create a multiple fault condition; therefore, operation should not be instituted until the fault or faults have been corrected. Use of battery power alone, during operation of the deice system, should be avoided because the battery output voltage will be lower than normal operating voltage and may produce ammeter readings below the shaded area of the meter.

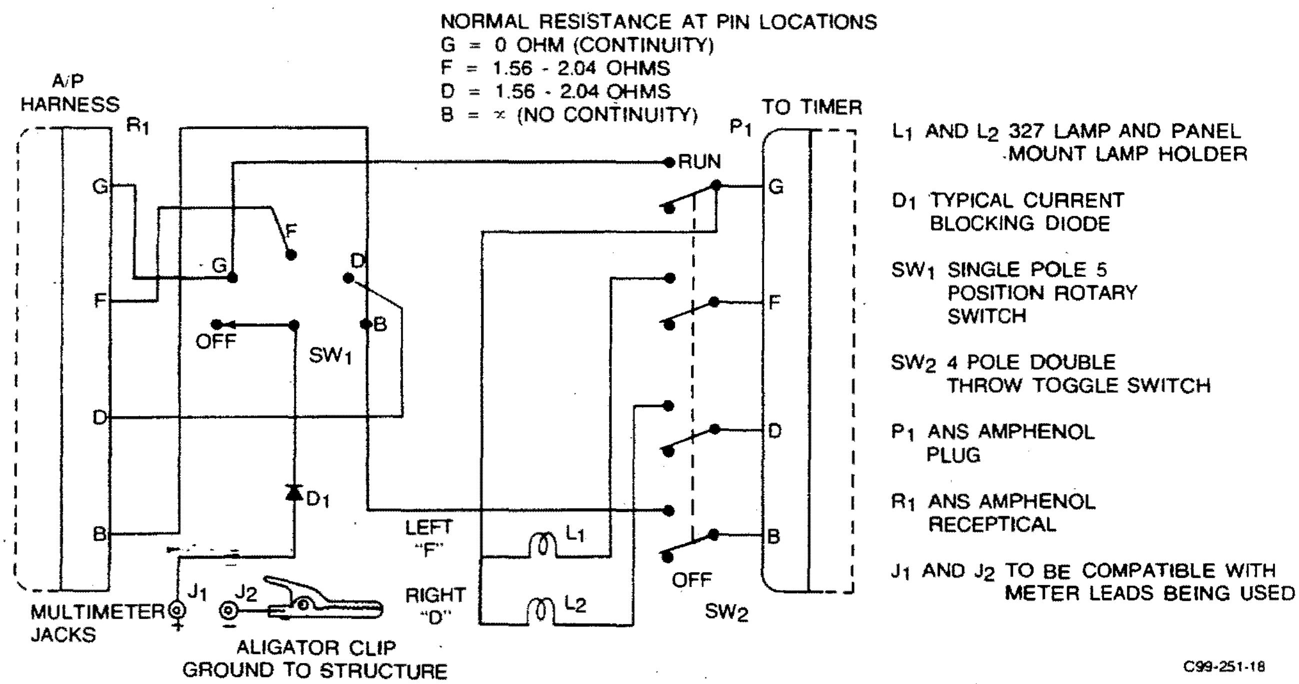
All resistance and continuity checks are made with the engines off, battery off and the timer disconnected. Resistance values specified in the troubleshooting chart may not be exact, as small variances may occur from one installation to another and will be subject to the accuracy of the particular resistance measuring instrument being used. For this reason it is recommended that a sensitive multimeter be used known to be accurate with ±1% (digital being preferred).

The test unit (Figure 101) was designed to be used in conjunction with these troubleshooting procedures and can be built with standard parts normally found in the shop. Operation and use of the test unit as outlined in the troubleshooting procedure makes it possible to positively check the timer in the airplane during system operation.

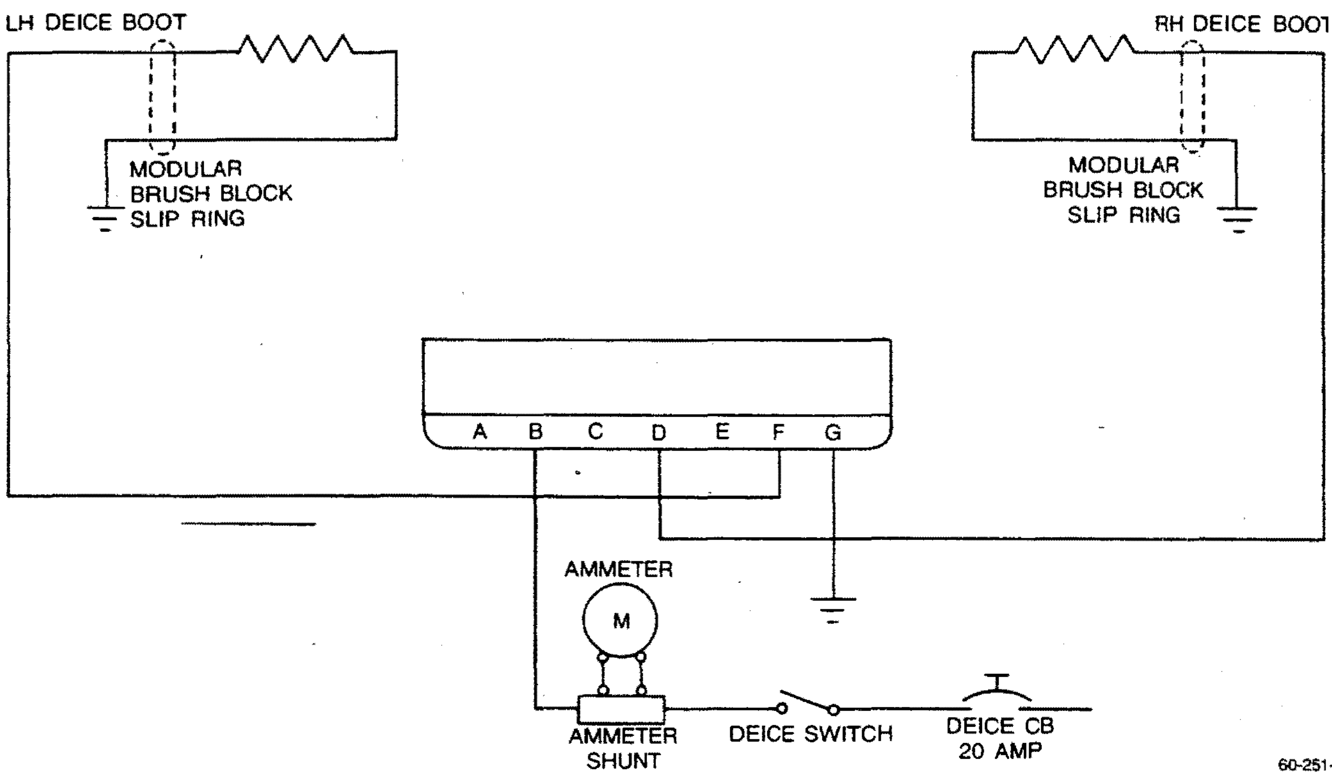
The troubleshooting chart which follows allows for an orderly flow of checks in a sequence consistent with the most convenient order of activity for the technician. The numbers in parenthesis, preceding some steps of the troubleshooting sequence, refer to notes found at the bottom of the chart. An electrothermal propeller deice control schematic (Figure 102) should be used for reference during system troubleshooting.

CAUTION

Propeller deice system must not be ground operated for extended periods of time as damage to the deice boots and pitting of the slip rings may occur.

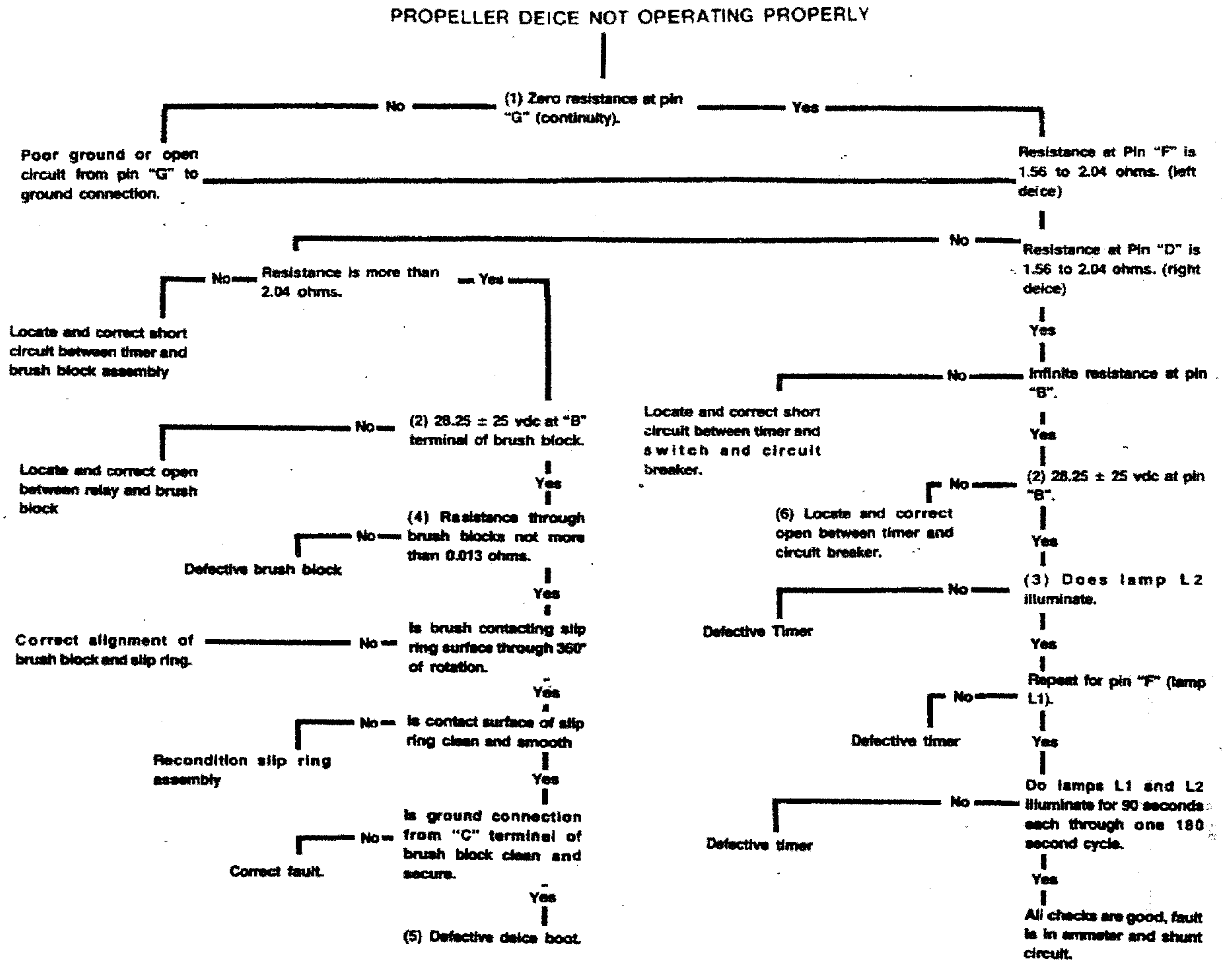


Electrothermal Propeller Deice Test Unit
Figure 101



Propeller Deice Control Schematic
Figure 102

TROUBLESHOOTING ELECTROTHERMAL PROPELLER DEICE (P-579 and after)



(1) All resistance and continuity checks are made with the battery switch OFF and the timer disconnected (if using test unit in Figure 101, placing SW 2 in the OFF position will disconnect timer)

(2) Voltage measurements are made with the propeller deice switch ON, circuit breaker in, and an auxiliary power unit connected or at least one generator on the line. Deice ammeter readings will vary directly with voltage.

(3) Reconnect timer (if using test unit Figure 101, place SW 2 in run position) advance timer by turning automatic propeller deice switch off then on again till lamp L2 illuminates. At no time during this check should both lamps (L1 and L2) be illuminated.

(4) Resistance is measured from face of brush block to terminal and must not exceed 0.013 ohms.

(5) Resistance measured through individual deiced boots should not exceed 5.9 ohm.

(6) Check switch and circuit breaker for continuity through switch in on position.

"END"

PROPELLER - MAINTENANCE PRACTICES

PROPELLER DEICER BOOT REMOVAL

a. Remove the propeller spinner.

b. On airplanes P-3 thru P-309, disconnect the deicer boot leads from the spinner bulkhead. Remove the clip securing the strap to the spinner bulkhead and the clamp securing it to the propeller hub.

c. On airplanes P-310 and after, disconnect the deicer boot leads from the clamp on the propeller hub.

d. Use MIL-M-13999 methyl ethyl ketone (21, Chart 207, 91-00-00) or toluol (22, Chart 207, 91-00-00) to soften the adhesion line between the boot and the blade, loosen one corner of the boot sufficiently to grasp it with vise grip pliers or a similar tool.

CAUTION

Unless the boot being removed is to be scrapped, cushion the jaws of any pulling tool to prevent damaging the boot surface.

e. Apply a slow, steady pull on the boot to pull it off the propeller surface while continuing to use the solvent to soften the adhesive.

f. Remove the remaining adhesive from the boot and propeller blade with toluol or methyl ethyl ketone.

PROPELLER DEICER BOOT INSTALLATION (Figure 201)

a. Position the deicer boot on the propeller blade so that its center line at the inboard end is adjacent to the split in the propeller blade clamp and 2 ± 1/16 inch outboard of the clamp, and the center line at the outboard end falls on the blade leading edge. Be sure the lead strap is in the proper position to be clamped to the blade retaining clamp.

b. Mask off an area approximately 1/2 inch from the end and each side of the boot.

c. Remove the deice boot and strip any paint in the masked area from the retaining clamp outboard. On propeller blades coated with urethane, sand lightly, using 320 grit sandpaper, to remove all glaze from the urethane coating. Clean the area thoroughly with MIL-M-13999 methyl ethyl ketone (21, Chart 207, 91-00-00). For final cleaning, wipe the solvent off quickly with a clean, dry, lint-free cloth to avoid leaving a film.

CAUTION

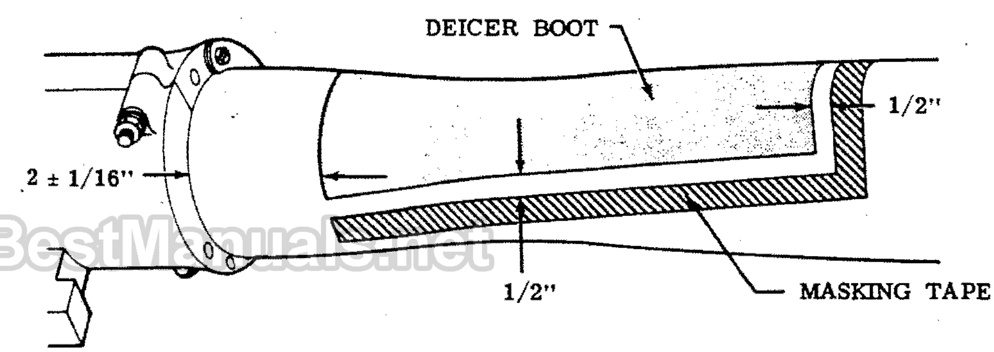
The metal and rubber parts must be thoroughly clean to assure maximum adhesion.

d. Moisten a clean cloth with methyl ethyl ketone or toluol and clean the unglazed surface of the deicer boot, changing the cloth frequently to avoid contamination of the clean area.

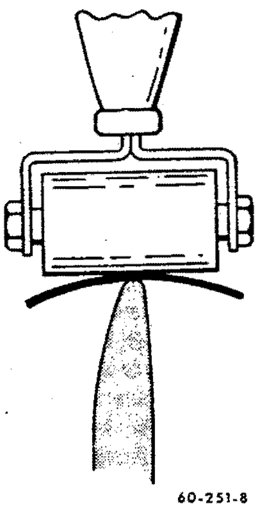
NOTE

To prevent the edges of the deicer boots from curling while applying the cement, place masking tape around the edges of the glazed side of the boot. Remove the masking tape before installing the boot.

e. Apply one even brush coat of EC-1300L cement (12, Chart 205, 91-00-00) to the propeller blade. Allow the cement to dry for at least one hour at 40°F or above when the relative humidity is less than 75%, or two hours if the



Deicer Boot Installation
Figure 201

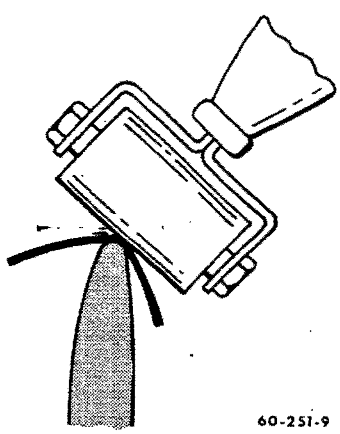


Center Rolling
Figure 202

humidity is between 75% and 90%. Do not apply the cement if the relative humidity is higher than 90%.

f. After allowing sufficient drying time, apply a second brush coat of cement to the propeller and one coat of cement to the unglazed surface of the deicer boot. Do not apply cement to more than 1/2 inch of the deicer lead strap. Allow the cement to dry.

g. Position the deicer boot on the propeller, starting 2 ± 1/16 inch from the blade retaining clamp, making sure the lead strap is in position to clamp to the blade retaining clamp. Moisten the cement lightly with methyl ethyl ketone or toluol and tack the boot center line to the blade leading edge. If the center line of the boot deviates from the blade leading edge, pull up with a quick motion and replace properly. Roll firmly along the center line with a rubber roller. (See Figure 202.)



Side Rolling
Figure 203

CAUTION

Never use a metal or wooden roller for this purpose, for they would damage the heating elements in the deicer boot.

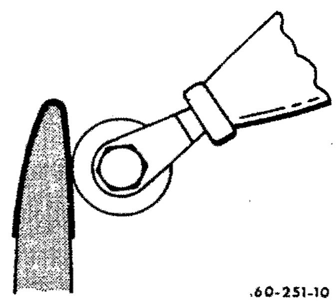
h. Gradually tilting the roller, work the boot carefully over each side of the blade contour. Avoid trapping air pockets under the boot. (See Figure 203.)

i. Roll outwardly from the center line to the edges of the boot. (See Figure 204.) If excess material at the edges tends to form puckers, work them out smoothly and carefully with the fingers.

j. Roll the tapered edges of the boot with a narrow steel stitcher roller.

k. Clean the blade with a clean cloth moistened with toluol or methyl ethyl ketone. Be careful not to let solvent run into the edge of the boot.

l. Apply one even brush coat or EC-801 sealer (11, Chart 205, 91-00-00) behind the lead strap where the boot and the blade meet.



Edge Rolling
Figure 204

NOTE

The EC-801 sealer is a two part sealer and must be thoroughly mixed. Mix the EC-801A and EC-801B combination as directed on the containers.

m. Apply one even brush coat of EC-801 sealer around the edges of the boot, allowing 1/16 to 1/8 inch overlap on the boot but extended to the masking tape. Remove the masking tape immediately after applying the sealer to obtain a neat border.

n. Allow sufficient time for the EC-801 to dry (from 24 to 72 hours, depending on conditions).

o. Apply satin finish black urethane paint to an area around the boot so that it covers all of the sealer and overlaps the edge of the boot and the blade by a minimum of 1/8 inch.

NOTE

To prevent propeller blade bearing grease from causing the boot to peel back or deteriorate, the urethane paint should be applied in a uniform coat so that grease cannot get to the boot cement or sealer.

p. Allow the urethane paint to dry as specified by the manufacturer.

q. On airplanes P-3 thru P-309, install the clamp securing the lead strap to the propeller blade retaining clamps. Connect the lead terminals and install the clip on the spinner bulkhead. There must be no slack between the terminal and the clip to assure enough slack between the clip and the clamp on the blade to allow propeller feathering.

r. On airplanes P-310 and after, connect the lead terminals to the clamp at the propeller hub.

DEICER TIMER CHECK (PRIOR TO P-579)

Experience in the field has indicated that often the timer is considered defective when the source of the trouble lies elsewhere. For this reason, the following test should be performed before the timer is removed as defective.

a. With the wiring harness disconnected at the timer and the deicer switch in the ON position, check the voltage from pin B of the harness plug to ground. If no voltage is present, the timer is NOT at fault; however, if system voltage is present at pin B, check the circuit from harness plug pin G to ground with an ohmmeter. If no circuit is indicated, the fault is in the ground lead rather than the timer. If ground connection is open, the timer step switch will not change position.

b. After the ground and power circuits have been checked, connect a jumper wire between pin B of the timer receptacle and terminal B of the connector plug and from pin G of the timer receptacle to ground. With the deicing system switch ON, check the voltage to ground from pin B of the timer. The voltmeter should indicate approximately 24 volts when the airplane battery supply is being used. Next, check the DC voltage to ground from pins C, D, E, and F, the points at which the system voltage is impressed in sequence to cycle power to the propeller deicers. Each of the plugs should read 24 volts in the following sequence.

Timing Sequence	Time ON	Areas of Prop Deicers Heated
Pin C	30 sec.	Right engine prop, Outb'd. halves
Pin D	30 sec.	Right engine prop, Inb'd. halves
Pin E	30 sec.	Left engine prop, Outb'd. halves
Pin F	30 sec.	Left engine prop, Inb'd. halves

NOTE

The timer does not reposition itself to start at pin C when the system is turned off, but will begin its cycling at the same position in which it was when last turned off. Cycling will then proceed in the order of C, D, E, and F as before.

After a voltage reading of 24 volts DC is obtained, hold the voltmeter probe on the pin until the voltage drops to zero before moving the probe on to the next pin in the sequence noted above. After the correctness of the cycling sequence has been established, turn the deicing system switch OFF at the beginning of one of the "on-time" periods and record the letter of the pin at which the voltage supply is present to facilitate performance of the following test.

DEICER TIMER CHECK (P-579 AND AFTER)

Experience in the field has indicated that often the timer is considered inoperable when the source of the trouble is elsewhere. For this reason, the following test should be performed before the timer is judged to be inoperable.

a. With the timer harness plug disconnected and the deicer switch in the ON position, check for voltage from pin B of the plug to ground. If no voltage is present, the timer is not defective; check the circuit breaker switch or the power supply. However, if system voltage is present at pin B, check the circuit from the harness to ground with an ohmmeter. If there is no continuity, the fault is in the ground circuit rather than the timer. If the ground circuit is open, the timer will not cycle.

b. After the ground and power circuits have been checked, connect a jumper wire between pin B of the timer receptacle and terminal B of the connector plug, and from pin G on the timer receptacle to ground. With the deicing system switch ON, check the voltage to ground from pin B of the timer. The voltmeter should indicate approximately 24 volts dc when the airplane battery supply is being used. Next, check the voltage to ground from pins D and F, the points at which the system voltage is impressed in sequence to cycle power to the LH and RH propeller deicers. The presence of 24 vdc system voltage should alternate at pins D and F for 90 seconds in duration as the timer cycles.

HEAT TEST (PRIOR TO P-579)

Before this test can be performed, the jumper wire installed for the timer test must be removed so that the connector plug can be replaced in the timer receptacle. Two men are required to perform this test, one in the pilot's compartment to monitor the ammeter while the other checks the deicer boots. The man in the pilot's compartment turns the deicer system switch ON while the man outside feels the deicer boots to see if they are heating properly. The man in the pilot's compartment observes the ammeter for the proper readings (14 to 18 amperes) throughout the timing sequence. The ammeter needle should deflect every 30 seconds in response to the switching action of the timer. Each time this occurs, the man in the pilot's compartment must notify the man inspecting the propeller deicer boots so that the latter can change the position of his hands to check the proper heating sequence of the propeller deicer areas. If any irregularities are detected, a continuity check should be performed on the wiring from the timer to the brush block holders and the propeller deicer terminal connections.

HEAT TEST (P-579 AND AFTER)

Remove the jumper wires that were installed for the timer test and reconnect the timer receptacle. To perform this test, two people are required - one person in the flight compartment to operate the propeller deice switch and observe the propeller deice ammeter, the other on the ground checking the deice boots for proper heating. While the person in the flight compartment observes the ammeter for a reading of 14 to 18 amps, the person on the ground checks for a rise in heat on each propeller deice boot for approximately 90 seconds on each side. If either boot fails to heat, check the circuit between the timer and the propeller deice boot for continuity.

CAUTION

While following the instructions of the above "Heat Test" section, rotate the propeller back and forth to prevent arcing between the brushes and slip ring.

WARNING

Before moving the propeller, ensure that the ignition switch if OFF and that the engine has completely cooled, as there is always the danger of a cylinder firing when the propeller is moved.

CONTINUITY TEST (PRIOR TO P-579)

After removing the plug from the timer, use an ohmmeter to check continuity from:

a. Pin C of the plug to the outboard terminal of one prop boot on the right engine.
b. Pin D of the plug to the inboard terminal of one prop boot on the right engine.
c. Pin E of the plug to the outboard terminal of one prop boot on the left engine.
d. Pin F of the plug to the inboard terminal of one prop boot on the left engine.
e. Pin G of the plug to ground.
f. Ground terminal of one prop boot on the right engine to ground.
g. Ground terminal of one prop boot on the left engine to ground.

CONTINUITY TEST (P-579 AND AFTER)

After removing the plug from the timer, use an ohmmeter to check continuity from:

a. Pin D of the plug to the terminal of the propeller deice boot on the right engine.
b. Pin F of the plug to the terminal of the propeller deice boot on the left engine.
c. Pin G of the plug to ground.
d. Ground terminal of the propeller boot on the right engine to ground.
e. Ground terminal of the propeller boot on the left engine to ground.

BRUSH TO SLIP RING RESISTANCE TEST

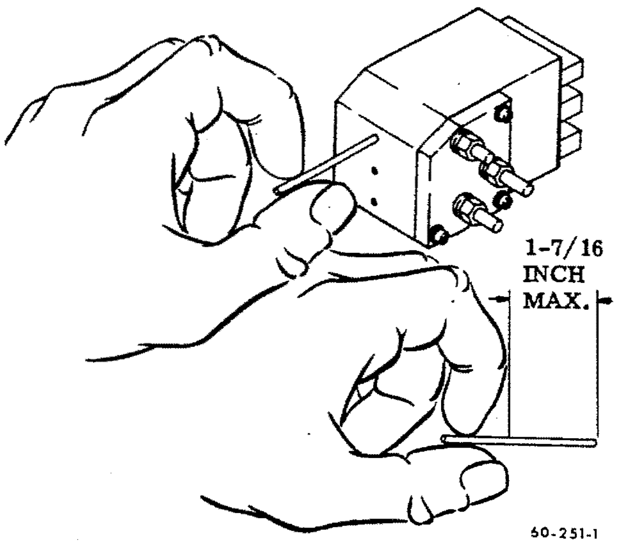
To check for incorrect resistance or the presence of a short or open circuit at the brush-to-slip ring contact, disconnect the harness at the timer and check the resistance from each deicer circuit lead (pins C, D, E, and F of the harness plug) to ground with a low range ohmmeter. If the resultant readings are not 1.55 to 1.78 ohms, disconnect the deicer lead straps to measure heater resistance individually. Individual boot resistance should measure between 4.58 and 5.26 ohms. If the readings in the first check are not within the accepted limits but those in the second check are, the trouble is probably in the brush-to-slip ring area. If the readings in the second check are also off, the deicer concerned is damaged and must be replaced.

BRUSH BLOCK RESISTANCE CHECK (PRIOR TO P-579)

To check for an open circuit, a short, or high resistance in the brush block, measure the resistance from the face of the brush to its terminal studs with a low range ohmmeter. If this resistance measures over 0.013 ohms, locate and repair the cause of excessive resistance. If the resistance is infinite, locate and correct the open circuit or ground, or else replace the brush. Check the resistance between the three terminal studs. This resistance should not be less than 5 megohms.

BRUSH BLOCK RESISTANCE CHECK (P-579 AND AFTER)

To determine if an open or short circuit or high resistance is present in the brush block, measure the resistance from the face of the brush to its terminal stud or receptacle pin with a low-range ohmmeter. The resistance reading should not exceed 0.013 ohms. If this ohm value is exceeded, locate and repair the problem area. If the resistance reading is infinite, locate and repair the open circuit or replace the brush. Check the resistance between the receptacle pins and the terminal studs. (The resistance reading should be less than 0.5 megohms).



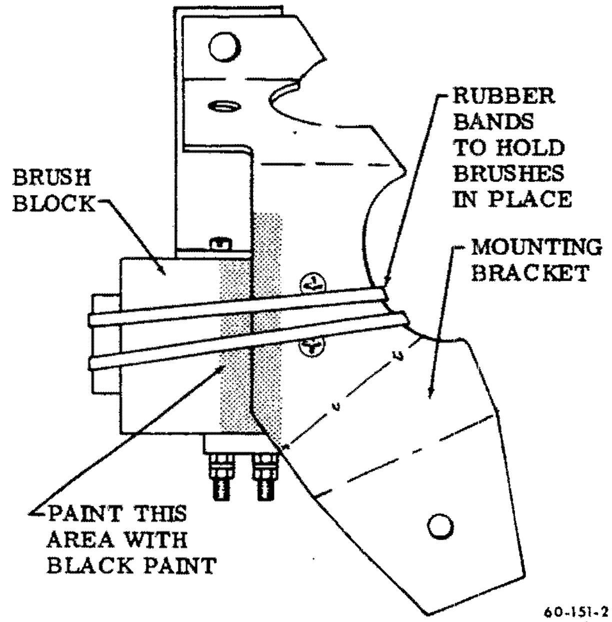
Determining Deicer Brush Wear
Figure 205

BRUSH REPLACEMENT (PRIOR TO P-579)

The propeller deicer brushes should be replaced when a minimum of 1/4 inch of brush material remains. It is good practice, however, to replace the brushes when 3/8 inch of the brush material still remains. Brush length may be determined by inserting a piece of safety wire into the holes at the back of the brush block assembly (Figure 205). When 1-7/16 inch dimension is measured, there is approximately 1/4 inch of brush material left. Replace the brushes as follows:

NOTE

The brush block and mounting bracket should be removed intact so the brush block's exact location with respect to the mounting bracket can be marked. This will facilitate alignment of the brush block during reinstallation.



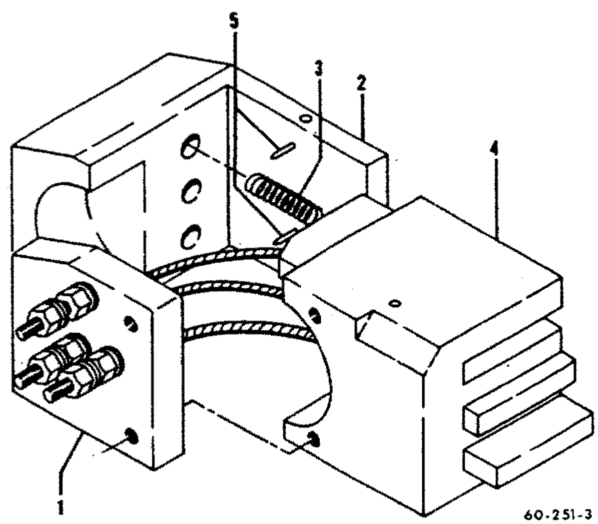
Marking Location of Brush Block
Figure 206

a. Loosen both ends of the brush block mounting bracket and remove the complete assembly.

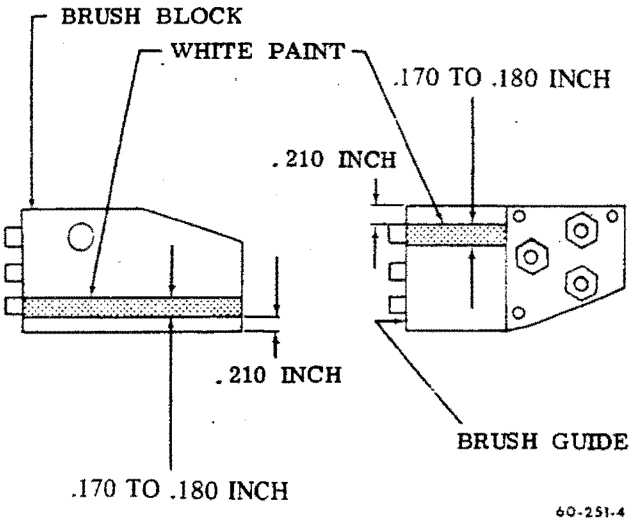
b. Tag the lead wires attached to the terminals on the brush block and disconnect them.

c. Clean the brush block and mounting bracket. Paint the side of the brush block and the edge of the mounting bracket as shown in Figure 206 with black paint.

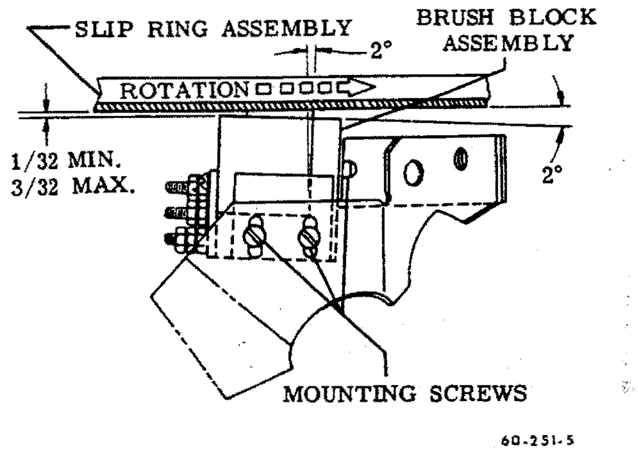
d. Remove the brush block from the mounting bracket.



Deicer Brush Block Assembly
Figure 207



Deicer Brush Alignment Strip
Figure 208



Deicer Brush Block Installation
Figure 209

e. Disassemble the brush block (Figure 207) by removing the screws attaching the terminal plate to the brush block, then separate the brush block by pulling the guide block approximately 1/4 inch toward the terminals to disengage the guide pins.

f. Mask off and paint a white stripe .170 to .180 inch wide on the brush block and brush guide. Locate as shown in Figure 208. The white stripes should be in line with the outer brush and will be used to align the brushes with the slip ring during reinstallation.

g. Remove the terminal plate, brushes and springs from the brush block.

h. Disconnect the wires from the brushes being replaced, noting which terminal they correspond to.

i. Solder the wires from the new brushes to the appropriate terminals, holding the "wicking" to 1/8 inch maximum.

j. Install each brush in its correct groove in the guide block. Insert new springs into the guide block behind the brushes. Taking care not to apply a side load on the brushes or damage or pinch the brush leads, bring the support block into position. Install the opposite end of the springs into their corresponding holes in the support block. Press the two blocks together until the guide pins in the support block slip into the holes in the guide block. Install the screws which hold the terminal plate to both blocks.

NOTE

When replacing brushes or brush retainer assemblies, always install new brush springs.

k. Check the amount of brush protrusion from the block. If the brushes protrude less than 9/16 inch, the brush leads should be untwisted to give more length. If this distance is more than 5/8 inch, the lead should be twisted to shorten the effective length until the brushes protrude from 9/16 to 5/8 inch. The brushes should then be checked for free sliding action.

l. Reinstall the brush block assembly on the mounting bracket, using the black paint (see step "c") as a guide for correct alignment.

m. Carefully push the brushes back into the brush block and secure them in place with a rubber band. (See Figure 206).

n. Using care not to bend or distort the mounting brackets, reinstall the brush block and bracket assembly as originally removed from the engine in step "a". Cut the rubber band and rotate the propeller to remove the broken pieces of rubber band.

NOTE

The white stripes on the top and bottom of the brush block should align with the outer slip ring. If the white stripes do not align with the outer slip ring it may be necessary to add or remove, all or part of the laminated shim. Removing shim material will move the brush block out. Each laminate in the shim is approximately .003 inch.

o. Check for proper clearance between the slip rings and the brush block (see Figure 209). The clearance should be 1/16 ± 1/32 inch with an angle of approximately two degrees from perpendicular, as measured toward the direction of slip ring rotation. If not correct, loosen the brush block mounting screws and move in the elongated holes to correct the brush block position.

p. To preclude arcing caused by the rough surfaces of the new brushes, the engine should be operated for at least five hours before the deicer system is turned on. This does not apply to ground checks of the system performed while the engine is not running.

BRUSH REPLACEMENT (P-579 AND AFTER)

The modular brush assembly (P/N 3E2071) is made up of two modules (P/N 3E2011-1 and P/N 3E2011-2), each consisting of a plastic housing with an integral brush and spring. These modular units are stacked with a spacer and held together by screws to produce the modular brush assembly. When a brush wears out, the module containing it must be replaced since individual brush replacements are not available. Replace the entire brush module when only 3/8 inch of the brush material remains.

NOTE

During measurement, only 1/16 inch of brush should protrude from the brush module, with this being the normal protrusion when the brush is installed on the airplane.

Brush wear is determined by inserting a pin into a hole in the back of the brush module as shown in Figure 205. On all modules having brushes with rods, the brush module should be replaced when the dimension shown in Figure 205 is 17/34 ± 1/32 inch. On all rodless brushes, the module should be replaced when this dimension is 1 7/64 ± 1/32 inch. Use the following procedures when replacing the brushes:

a. Disconnect the wire harness terminals at the modular unit terminals.

b. Remove the screws, nuts, and washers that secure the modular unit to the mounting bracket.

c. Remove the assembly retaining screws and separate the modules and spacers.

d. Replace each module with another of the same part number. (The part number is etched into the plastic housing.)

e. Restack the modules and spacers as they were unstacked in step "c". (Stacking arrangement may be changed if there is interference with any other engine or propeller component.)

f. Install the assembly screws so that the screw head fits in the recess in the spacer. Place the flat washer between the star washer and the modular housing and install the retaining nut. Ensure that the assembly is square before tightening the assembly screws.

g. Place the modular brush assembly on the mounting bracket and insert the mounting screw through both the bracket and the brush block assembly. Place one washer under the head of the screw and one under the nut.

h. Before installing the retaining nuts, ensure that the brushes are aligned with the slip rings so that the entire face of the brush is in contact with the copper rings. If the brushes do not align with the slip rings throughout the entire 360 degree rotation of the slip ring, add or remove spacers (P/N 4E2218-3) between the modules until the brushes are properly aligned with the approximate center of the copper ring.

i. Install the retaining nut and washers, ensuring that 1/16 ± 1/32 inch is maintained between the brush module and the slip ring surface. To prevent damage to the brushes, the modular brush assembly should be angled so that the brushes contact the slip ring at an angle of approximately 2 degrees from perpendicular as measured toward the direction of slip ring rotation.

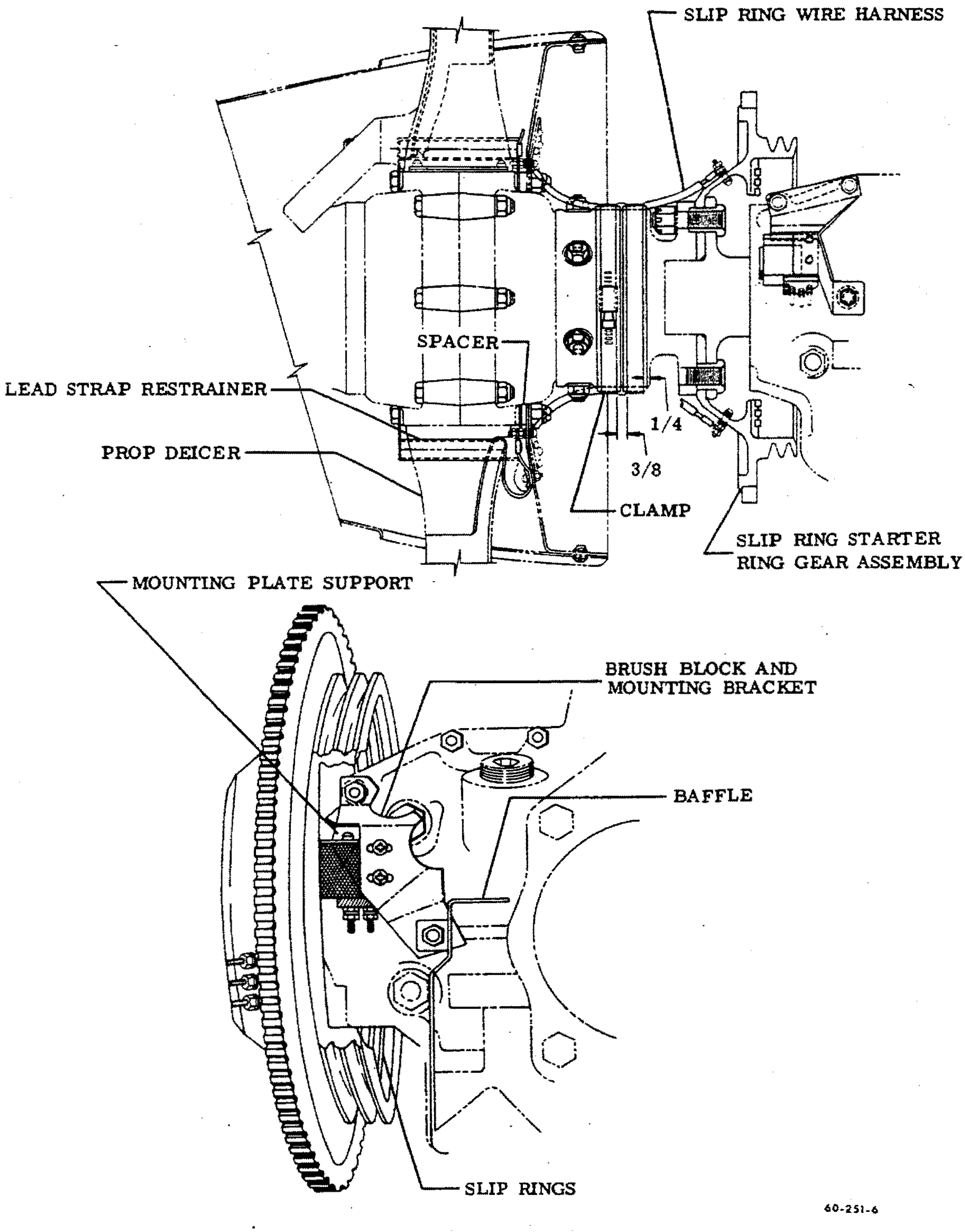
j. Reconnect the wire harness terminals to the modular unit terminals.

SLIP RING MACHINING

Slip rings which have roughened or damaged surfaces, but which are structurally sound, can be machined and restored to serviceability. Remove the slip ring assembly from the aircraft and mount it in a lathe. Position is concentrically in the lathe, with not over 0.002 inch wobble or run-out over 360 degree rotation. Take light cuts for a smooth finish and cut no deeper than required to remove surface damage. The contact surfaces of the three slip rings must be parallel within 0.005 inch, and flat within 0.005 inch overall. Deviation from flat is not to exceed 0.002 inch over a 4 inch arc. If necessary, undercut the insulation between the slip rings to a depth of 0.020 to 0.030 inches below the contact surface of the slip rings. In this operation, width of the slip ring MUST NOT be reduced more than 0.005 inch. Contact surfaces of the slip rings must have a finish of 29-35 micro inches. Deburr the slip ring edges and reinstall in the aircraft and align.

NOTE

If, in machining, the solder or braze connection on the underside of the slip ring is exposed, replacement of the slip ring assembly will be necessary.



Propeller Deicer Installation
Figure 210

"END"

CHAPTER 32

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CHAPTER 32 - LANDING GEAR

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GENERAL - DESCRIPTION AND OPERATION

The landing gear is operated by a split-field series-wound motor and an actuator located under the cabin floorboards aft of the main spar. One field is used to drive the motor in each direction. To prevent overtravel of the landing gear, a dynamic braking relay simultaneously breaks the power circuit to the motor and makes a complete circuit through the armature and the unused field winding. The motor then acts as a generator and the resulting electrical load on the armature stops the landing gear almost instantly.

The landing gear motor is controlled by the gear extension switch located on the left subpanel. The larger upper arms and the lower arm of the actuator, in conjunction with rod assemblies and linkage, control extension and retraction of the main and nose landing gear. Rod assemblies attached to the smaller upper actuator arms operate the inboard main landing gear doors.

Landing gear limit switches, located adjacent to the actuator, limit the gear travel during the extend and retract cycle. These switches, when actuated, terminate the landing gear travel.

To prevent accidental landing gear retraction on the ground, a safety switch on the left main landing gear breaks the control circuit whenever the strut is compressed.

CAUTION

Never rely on the safety switch to keep the gear down while taxiing, landing, or on the takeoff roll. Always check the position of the landing gear switch.

The Duke landing gear incorporates Beech air-oil type shock struts that are filled with both compressed air and hydraulic fluid. Their correct inflation should be assured before each flight.

SAFETY SYSTEM

The optional landing gear safety system functions through the action of a solenoid in the landing gear position switch in conjunction with a three-position safety system switch, two pressure switches mounted on the inboard side of the left main landing gear wheel well and two microswitches located adjacent to the existing throttle position warning switches.

Each pressure switch is connected into the pitot and static system. The pressure switch in the gear-up circuit is actuated by the pressure differential that exists between the pitot and static systems and will close with increasing pressure at approximately 85 ± 2 knots. The pressure switch in the gear-down circuit will close with decreasing pressure at 120 ± 2 knots. When the landing gear position switch is in the UP position and an airspeed of 85 ± 2 knots. has been attained, the pressure switch in the gear-up circuit closes and actuates a relay mounted on the front spar, thus completing the circuit and retracting the landing gear. A diode locks the relay in the closed position until the retraction cycle is completed. For the preceding to occur, however, the microswitch adjacent to the throttle position switch must also be in the open position. This microswitch is actuated by the throttle control when the throttles are advanced sufficiently for the manifold pressure gage to register approximately 17 ± 1 in. Hg. Conversely, if the throttles are retarded beyond the position corresponding to approximately 17 ± 1 in. Hg of manifold pressure, the microswitch will close. If at the same time the microswitch closes, the airspeed has dropped below 120 ± 2 knots, the resultant pressure differential between the pitot and static systems will actuate the pressure switch in the gear-down circuit. With both the microswitch and pressure switch closed, the current flow through the solenoid will cause the landing gear position switch to drop into the DOWN position, thus completing the gear-down circuit.

If the landing gear position switch is placed in the UP position while the landing gear safety system is in the ON position, the landing gears will retract when the following conditions are mutually fulfilled.

a. The airplane must have attained an airspeed of at least 85 ± 2 knots.
b. The throttle setting must have been advanced sufficiently to have produced a manifold pressure of approximately 17 ± 1 in. Hg.

By the same token, the landing gear automatically extends under the following conditions:

a. The airspeed must have dropped below 120 ± 2 knots.
b. The throttle setting must have been retarded enough for manifold pressure to have dropped below approximately 17 ± 1 in. Hg.

The safety system switch is a three position switch, with normally ON or OFF positions. The switch also contains a momentary or test position for checking that the system is functioning properly. When released from the test position, the switch returns to the ON position.

MANUAL LANDING GEAR EXTENSION SYSTEM

In the event of landing gear malfunction in flight, the gear may be manually extended, but not retracted, by a hand crank located below copilot's seat.

WARNING

If the gear has been extended manually for emergency reasons, the airplane must be put on jacks and inspected before the gear controls are returned to their normal position.

"END"

TROUBLESHOOTING
LANDING GEAR ELECTRICAL SYSTEM

TROUBLE		PROBABLE CAUSE		REMARKS
1. Landing gear motor fails to shut off when gear is retracted.	a.	Up limit switch out of adjustment.	a.	Readjust switch.
	b.	Defective switch.	b.	Replace switch.
2. Landing gear fails to retract.	a.	Safety switch not closing.	a.	Readjust.
	b.	Up limit switch remaining open.	b.	Replace limit switch.
3. Landing gear motor fails to shut off when gear is extended.	a.	Down limit switch does not open.	a.	Readjust limit switch.
	b.	Defective down limit switch.	b.	Replace limit switch.
4. Landing gear actuator is hitting internal stops.	a.	Limit switch out of adjustment.	a.	Readjust limit switch.
	b.	Dynamic brake switch defective.	b.	Replace switch.
5. Warning horn inoperative or malfunctioning.	a.	Open or grounded circuit.	a.	Check continuity.
	b.	Throttle switches inoperative.	b.	Check and adjust as necessary.
6. Landing gear fails to extend.	a.	Tripped circuit breaker.	a.	Reset circuit breaker.
	b.	Down limit switches open.	b.	Check down limit switch. With the gear retracted the down limit switch should be closed.
	c.	Open circuit.	c.	Run a continuity check on the down limit switch.
7. Landing gear will not retract or extend.	a.	Bad electrical connections.	a.	Run a continuity check from circuit breaker to switch. Inspect the dynamic brake relay.
	b.	Landing gear motor not grounded.	b.	Check motor ground.
	c.	Defective control circuit.	c.	Check items 1 through 3.

"END"

MAIN GEAR AND DOORS - MAINTENANCE PRACTICES

MAIN GEAR SHOCK ABSORBERS

To check the fluid level in the landing gear shock absorbers, deflate the strut by releasing the air through the valve and permit the strut to fully compress, then remove the filler valve.

WARNING

Do not remove the filler valve until all air pressure has been released or it may be blown off with considerable force, causing injury to personnel and property damage.

If the fluid level is low, add hydraulic fluid MIL-H-5606 (13, Chart 207, 91-00-00) until the fluid overflows slightly. Slowly cycle (compress and extend) the strut to expel any trapped air. Add fluid, as necessary, and install the filler valve.

With the airplane resting on the ground and the fuel cells full, inflate the main strut until 3 inches of the piston is exposed. Rock the airplane gently to prevent possible binding of the piston in the barrel when inflating.

CAUTION

Do not inflate the struts while the airplane is on jacks, since sudden extension or over-inflation of the struts may bend the torque knee.

LUBRICATION

MAIN WHEEL BEARINGS AND GREASE FITTINGS

Lubricate the main wheel bearings and grease fittings as detailed in the Lubrication Chart, Chapter 12-20-00.

UPLOCK ROLLERS

AIRPLANE SERIALS P-3 THROUGH P-154, P-156 THROUGH P-162, P-167 THROUGH P-171 AND P-181 PRIOR TO COMPLIANCE WITH SERVICE INSTRUCTIONS No. 0482-211.

The uplock rollers on these serials should be lubricated after 50 hours with SAE 10W-30 oil, and removed from the airplane and packed with MIL-G-23827 grease (11, Chart 207, 91-00-00), every 100 hours or any time that, while cleaning the wheel well, the bearings are subjected to degreasing with solvent under pressure.

NOTE

The grease fitting on the drag leg, directly above the uplock roller bearing, does not supply lubrication for the uplock roller bearing.

The uplock roller bearing may be lubricated as follows:

a. Place the airplane on jacks.
b. Partially retract the landing gear.
c. Remove the bolt attaching the uplock roller and the "V" brace drag leg center hinge point.
d. Remove the uplock roller bearing from the bolt.
e. Hold a finger over one end of the uplock roller center bearing race and place a grease gun against the opposite side of the bearing. As grease is pumped into the inner bearing race, it will be forced through the hole in the inner race and into the bearing cavity. Completely fill the bearing with grease.
f. Reinstall roller bearings and attaching bolt.

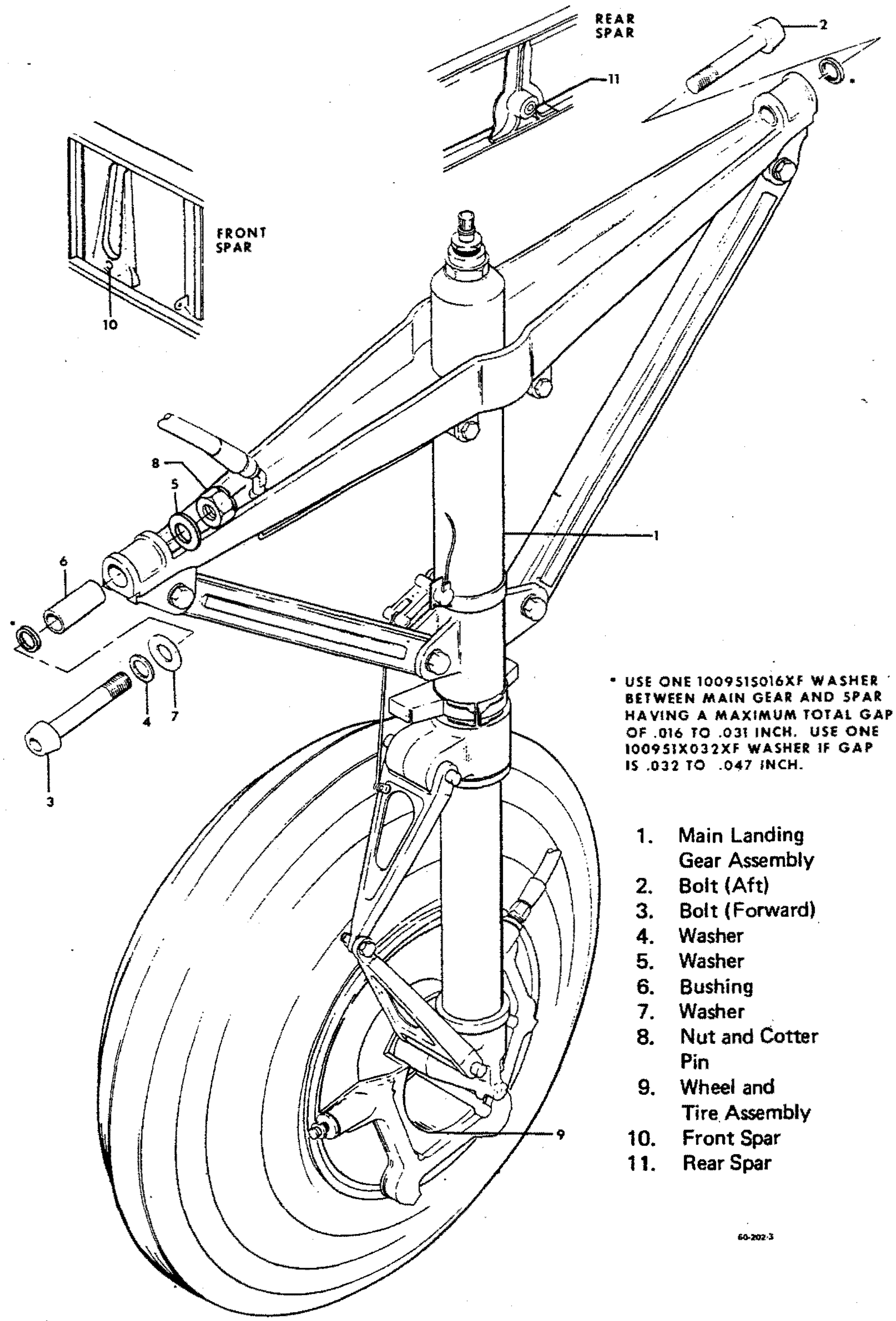
AIRPLANE SERIALS P-155, P-163 THROUGH P-166, P-172 AND AFTER, EXCEPT P-181, AND PRIOR AIRPLANE SERIALS IN COMPLIANCE WITH SERVICE INSTRUCTIONS No. 0482-211.

The uplock rollers on these serials are equipped with a grease fitting installed in the uplock roller bearing bolt and may be lubricated using a pressure grease gun. The uplock rollers should be lubricated using MIL-G-23827 grease (11, Chart 207, 91-00-00), each 100 hours, or any time that while cleaning the wheel well, the bearings are subjected to degreasing with solvent under pressure.

MAIN GEAR REMOVAL
(Figure 201)

When removing the landing gear, take care to preserve the original adjustments at the rod end fittings to facilitate reassembly.

a. With the airplane on a jack, retract the gear until the inboard landing gear door is in the fully open position.
b. Remove the outboard landing gear door from the landing gear strut.
c. Disconnect the inboard landing gear door actuating rod at the forward door hinge.
d. Unsnap the canvas cover and disconnect the uplock assembly from the strut.



* USE ONE 100951S016XF WASHER BETWEEN MAIN GEAR AND SPAR HAVING A MAXIMUM TOTAL GAP OF .016 TO .031 INCH. USE ONE 100951X032XF WASHER IF GAP IS .032 TO .047 INCH.

1. Main Landing Gear Assembly
2. Bolt (Aft)
3. Bolt (Forward)
4. Washer
5. Washer
6. Bushing
7. Washer
8. Nut and Cotter Pin
9. Wheel and Tire Assembly
10. Front Spar
11. Rear Spar

Main Gear Installation
Figure 201

e. Open the brake cylinder bleed ports and pump all fluid from the system.

f. Disconnect the hydraulic line where the flexible hose couples to the tubing on the landing gear.

g. Disconnect the safety switch wire. (Left gear only).

h. Remove the bolt attaching the lift leg to the strut.

i. Remove the access door in the lower surface of the wing leading edge for access to the forward hinge bolt retaining nut and remove the nut. The rear strut brace hinge bolt is accessible by lowering the flap.

j. Remove cotter pins and nuts (8), washer (5), bolts (2 and 3), washers (4 and 7), and bushings (6) from the front and rear spars (10 and 11).

k. Lower the main gear assembly away from the airplane, being careful not to bend the skin at the wheel well edge.

MAIN GEAR INSTALLATION
(Figure 201)

a. Carefully position the main gear assembly in place against the front and rear spars (10 and 11).

b. Align bolt holes and install bushing (6), bolts (2 and 3), washers (4, 5, and 7), and nuts (8). Torque to 250 to 400 inch-pounds. Install new cotter pins.

NOTE

Use one 100951S016XF washer between main gear and spar having a maximum total gap of .016 to .031 inch. Use one 100951X032XF washer if gap is .032 to .047-inch.

c. Install the access door in the lower wing leading edge.

d. Install the bolt attaching the lift leg to the strut.

e. Connect landing gear safety switch wire. (Left gear only).

f. Connect the brake hydraulic line.

g. Connect the uplock assembly to the strut and snap the canvas cover in place.

h. Connect the inboard landing gear door actuating rod to the forward door hinge.

i. Install the outboard landing gear door to the landing gear strut.

j. Bleed the brake system.

k. Operate the landing gear and check for proper rigging of the uplock and doors.

100-HOUR INSPECTION

ACTUATOR AND MOTOR - Check the actuator and motor for security, visible damage and condition. Check motor wiring for breaks and chafed or deteriorated insulation. Check all actuating rods for cracks, evidence of bending and security.

LANDING GEAR STRUT - Inspect the strut and attaching components for cracks, security, condition, and leakage at the air filler valve and piston area.

STRUT FLUID LEVEL - Inspect the strut for proper inflation. If leakage is detected, deflate the strut and check the fluid level.

"END"

NOSE GEAR AND DOORS - MAINTENANCE PRACTICES

NOSE GEAR SHOCK ABSORBER

To check the fluid level in the landing gear shock absorber, deflate the strut by releasing the air through the valve and permit the strut to fully compress, then remove the filler valve.

WARNING

Do not remove the filler valve until all air pressure has been released or it may be blown off with considerable force, causing injury to personnel and property damage.

If the fluid level is low, add MIL-H-5606 hydraulic fluid (13, Chart 207, 91-00-00) until the fluid overflows slightly. Slowly cycle (compress and extend) the strut to expel any trapped air. Add fluid, as necessary, and install the filler valve.

With the aircraft resting on the ground and the fuel cells full, inflate the nose strut until 4-1/16 to 4-5/16 inch of the piston is exposed. Rock the aircraft gently to prevent possible binding of the piston in the barrel when inflating.

CAUTION

Do not inflate the strut while the aircraft is on jacks, since sudden extension or over-inflation of the strut may bend the torque knees.

LUBRICATION

Lubricate the nose wheel bearings and grease fittings as detailed in the Lubrication Chart in Chapter 12-20-00.

NOSE GEAR REMOVAL (Figure 201)

When removing the nose gear, take care to retain the original adjustments at the rod end fittings to facilitate reassembly.

a. With the aircraft on a jack, partially retract the landing gear to relieve the load on the retract rod compression spring.
b. Disconnect the drag leg at its fitting on the nose gear brace assembly.
c. Disconnect the shimmy dampener at the nose gear.
d. Disconnect the steering mechanism at the nose gear.
e. Disconnect the landing light wiring.
f. Remove the nose baggage compartment flooring that covers the area on either side of the wheel well to gain access to the hinge bolts.
g. Remove cotter pins (5), nuts (4), washers (2), bolts (1) and bushings (3).
h. Lower the nose gear assembly from the nose wheel well.

NOSE GEAR INSTALLATION (Figure 201)

a. Carefully position the nose gear assembly against the nose wheel well structure.
b. Align bolt holes and install bushings (3), bolts (1), washers (2), nuts (4) and cotter pins (5).

NOTE

Use 100951X016YX and 100951X032YX washers, as required, to obtain total end play between the nose gear assembly and supports, of .000 to .016-inch.

c. Install the nose baggage compartment flooring.
d. Connect the landing light wire.
e. Connect the drag leg on the nose gear brace assembly.
f. Connect the steering mechanism to the nose gear.
g. Check the shimmy dampener adjustment, then connect the shimmy dampener to the nose gear.
h. Operate the landing gear and check for proper rigging and nose gear adjustment.

SHIMMY DAMPENER REMOVAL

a. Remove the nut, washers and bolt attaching the shimmy dampener to the nose landing gear.
b. Remove the nut, washer, bolt and spacer attaching the shimmy dampener to the nose wheel well structure.

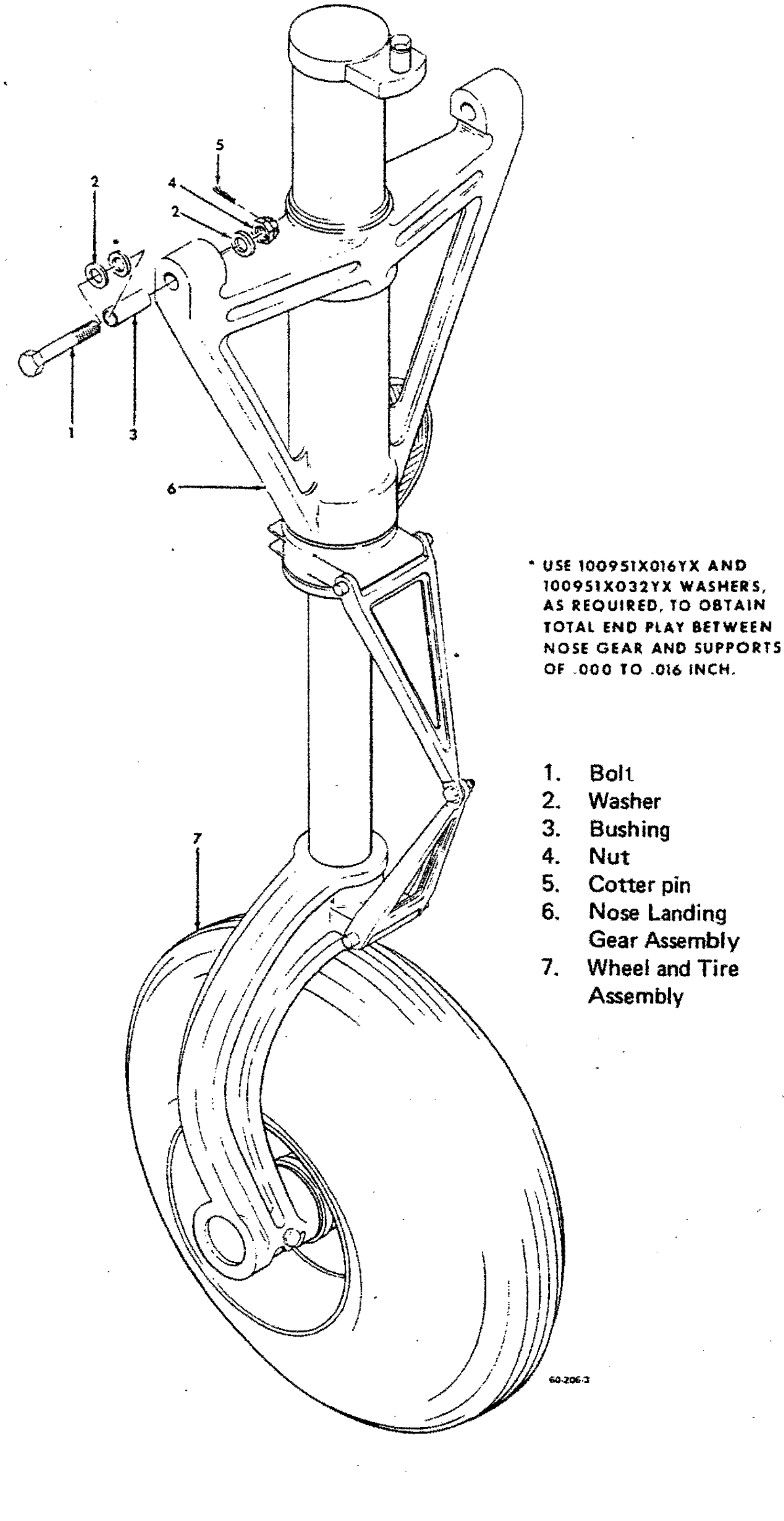
SHIMMY DAMPENER INSTALLATION

a. Position the aft end of the shimmy dampener in the bracket on the nose wheel structure and install the spacer, bolt, washer and nut.
b. Adjust the shimmy dampener with the nose wheel in the extreme left position. The piston travel of the dampener should be adjusted to extend 1/16 to 1/4 inch beyond the attach point on the steering yoke.
c. Return the nose wheel to neutral and install the bolt, nut and washer.

100-HOUR INSPECTION

LANDING GEAR STRUT - Inspect the strut and attaching components for cracks, security, condition, and leakage at the air filler valve and piston area.

STRUT FLUID LEVEL - Inspect the strut for proper inflation. If leakage is detected, deflate the strut and check the fluid level.



1. Bolt
2. Washer
3. Bushing
4. Nut
5. Cotter pin
6. Nose Landing Gear Assembly
7. Wheel and Tire Assembly

Nose Gear Installation
Figure 201

"END"

cycling the gear listen for unusual noises at the motor and actuator. Cycle the gear a minimum of six times.

k. Install the access covers, carpet and the front seat.

l. Install the access door on the bottom of the fuselage.

LANDING GEAR DYNAMIC BRAKE RELAY REMOVAL

a. Remove the cabin right front seat.

b. Remove the access cover on top and directly behind the forward carry through structure.

c. Disconnect the electrical wiring at the dynamic brake relay.

d. Remove the two attaching screws and the relay.

LANDING GEAR DYNAMIC BRAKE RELAY INSTALLATION

a. Install the dynamic brake relay with the two attaching screws.

b. Connect the electrical wiring to the relay.

c. Install the access cover and the right front seat.

d. Cycle the landing gear and check for proper braking action. The gear should stop almost instantly.

CAUTION

When landing gear is approaching its extreme of travel, intermittently actuate the landing gear relay circuit breaker to prevent damage to the wing and fuselage structure and the actuating rods, linkage and the landing gear components.

LANDING GEAR RIGGING (Figure 201)

NOTE

Read the entire rigging procedure before attempting to rig the landing gear system. Physically locate each item as you read the procedure through.

CAUTION

Do not reverse the landing gear direction of travel without bringing the gear to a complete stop. If the direction of travel is reversed using the landing gear selector switch, damage to the sector gear may result. Use the landing gear relay circuit breaker to start or stop the landing gear during rigging.

Battery voltage is not sufficient to properly cycle the landing gear during rigging. A 28.25 ($\pm$0.25) volt auxiliary power unit capable of maintaining the initial setting within 0.25 volt during the extension and retraction cycles is recommended.

CAUTION

Excessive operation of the landing gear motor without proper cooling may cause damage to the motor. Allow five minutes cooling time after each extension and retraction cycle.

Whenever the landing gear mechanism is removed or disconnected, the landing gear should be checked to see that the system is properly rigged.

CAUTION

After making an adjustment to the gear, operate the landing gear intermittently as the system nears the limits of the retraction/extension cycle to prevent damage due to overtravel.

Prior to jacking the airplane, ensure that an unbalanced condition does not exist. Fuel should be distributed evenly in both wings to prevent an unbalanced condition which could cause the airplane to be unstable while on jacks.

a. With the airplane on jacks, allow adequate floor clearance for wheels during retraction or extension.

CAUTION

Care should be taken to ensure that the main gear retract rods are not lengthened far enough to damage the inboard landing gear doors.

b. If it is determined that the entire landing gear is out of rig, take the following precautions to prevent damage to the gear and airplane: Lengthen the main and nose gear retract rods sufficiently to eliminate the danger of the main gear V-brace damaging the wing skin when the gear is retracted. Place the uplock block in the lower position.

c. Disconnect the nose wheel door linkage. Secure the nose wheel door out of the way with tape. Disconnect the main wheel outboard door linkage at the strut.

d. Screw the stop bolts (on the main gear V-brace assembly) in until four or five threads are showing.

NOTE

The actuators (used on serials P-577 and after) may be installed on eariler airplanes. The new actuator is identified by part number 60-810030-5 or -7 and white epoxy paint on the upper actuator arm and on the upper and lower actuator housing.

e. Retract the landing gear to its 2/3 up position, then stop and inch the gear the remaining distance to the uplimit switch by intermittent operation of the landing gear relay circuit breaker. Check the emergency handcrank for 1/8 to 1/4 turn (or 5/8 to 3/4 turn on airplanes using 60-810030-5 or 60-810030-7 white actuator) free counterclockwise movement before the sector gear contacts the gearbox internal stop. If proper internal clearance is not obtained, adjust the landing gear uplimit switch. Locate the landing gear uplimit switch adjustment screw on the actuator arm and adjust the screw to stop the landing gear on its up cycle at the point where proper internal clearance is maintained.

CAUTION

The gearbox may be damaged if allowed to run full cycle into the internal stops. To preclude this possibility, the limit switches should initially be adjusted aft, for an early shutdown, if an out-of-adjustment condition is suspected.

NOTE

All adjustment and rigging of limit switches should be accomplished using an external power source adjusted to 28.25 (±0.25) volts. Due to overtravel, the landing gear will not stop at the same position that the limit switches are actuated.

On serials P-139 and after, there are two switch assemblies, one on each side of the actuator.

f. Extend the landing gear to its 2/3 down positic then stop and inch the gear the remaining distance to t downlimit switch by intermittent operation of the landi gear relay circuit breaker. Check the emergency handcra for 1/8 to 1/4 turn (or 5/8 to 3/4 turn on airplanes using 6 810030-5 or 60-810030-7 white actuators) free clockwi movement before the sector gear contacts the gearb internal stop. If proper internal clearance is not obtaine locate the landing gear downlimit switch adjustment scr on the upper arm of the landing gear actuator and adjust tl screw to stop the landing gear on its down cycle at the po where proper internal clearance is achieved.

WARNING

Do not operate the handcrank with the power on.

g. Extend and retract the gear two or three times assure that the switches are correctly set. Check tl handcrank each time to assure a free movement of 1/8 1/4 turn (or 5/8 to 3/4 turn on airplanes using 60-81003C or 60-810030-7 white actuators) before the sector ge contacts the internal stops.

h. Adjust both the right and left main retract rods maintain a minimum clearance of 0.12 inch between tl knee joint of the V-brace and wing skin with the landing ge retracted. To determine V-brace and wing skin clearanc retract the landing gear and slide a 0.12-inch feeler gau between the landing gear knee joint V-brace lift leg and tl top wing skin. The main gear should retract only far enou to clear the inboard door (see Step k) in addition maintaining the minimum 0.12-inch clearance. To decrea the clearance between knee and top wing skin, short retract rod.

i. To provide an attachment point for a spring sca when rigging the door tension, fabricate a hook which ca be screwed into the hole provided in the inboard gear do

j. With the gear retracted, rig the inboard landi gear door linkage so that a force of 28 to 40 pounds required to deflect the forward outboard corner of the do 1/8 inch. With the gear down, 25 to 40 pounds should l required to deflect the forward outboard corner 1/8 inch. Tl doors are adjusted by disconnecting the linkage rods at tl clevis fitting and screwing the rods in or out to vary th length.

k. There shall be a clearance of 0.19 to 0.30 in between the main landing gear axle and the inside surfa of the inboard door, at its closest point, with the gear fu retracted.

NOTE

To measure the clearance between the main landing gear axle and the inside surface of the inboard door, place a 1/2-inch thickness or more of artists' clay or equivalent on the axle. Place one thickness of paper over the clay to prevent the clay from sticking to the door. Retract the landing gear and leave in fully retracted position long enough for the clay to remain in the flattened position, then extend the gear. Remove the paper and measure the depth of the clay. The depth should be between 0.19 to 0.30 inch.

CAUTION

Install the main landing gear door pushrod attaching bolt in the door linkage bracket with the head to rear. If installed wrong, the bolt may catch in the fuselage skin and root rib of the wing, causing damage to the landing gear retract mechanism or preventing the gear from retracting.

l. When the proper setting is obtained, leave the gears in the fully retracted position and screw the stopbolt down against the strut. To assure a firm setting, insert a 0.003-inch feeler gage under the bolt head and adjust the bolt until a firm, steady effort is required to pull the feeler gage out. With the feeler gage removed, screw the bolt 3/4 turn (counterclockwise, when viewing bolt head) from initial contact with no clearance. Tighten the locknut securely.

m. Fabricate a spring feeler gage from a piece of metal 0.002 inch thick by 1/2 inch wide by 1-1/2 inches long, a rubber band, and a hook made of a heavier piece of metal (see Figure 202). The rubber band must stretch tight enough to pull the 0.002-inch material from the torque knee contact surface when sufficient force is applied.

NOTE

On those airplanes prior to P-183, except P-163 through P-166, P-177, and P-181 which have not incorporated Kit No. 60-8006-1S, accomplish Step "n". Airplanes P-163 through P-166, P-177, P-181, and P-183 and after and earlier airplanes which have incorporated Kit No. 60-8006-1S, accomplish Step "o".

n. With the main landing gear fully extended, insert a 0.002-inch feeler gage, as shown in Figure 202 in the knee contact surface of the gear lift leg. Apply a force as shown in Detail "F" of Figure 201 until the knee joint deflects just enough to allow movement of the feeler gage. The knee should deflect when a force of 65 to 75 pounds is applied. To increase the tension, add washers (Part Number 100951S063XP) between the inboard end of retract rod spring and the end of retract rod. To decrease tension, remove washers.

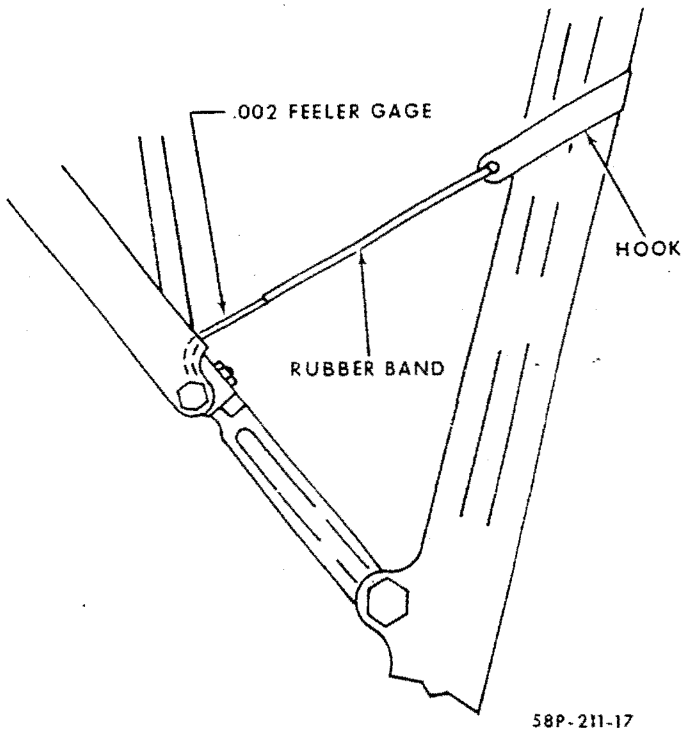
NOTE

If proper downlock tension cannot be established install a new spring. Check for a total minimum gap of 0.060 inch between the spring coils. The total spring gap is the sum of all gaps measured between the coils. Make certain the spring coils do not stack during gear operation.

o. With the main landing gear fully extended and the downlock disconnected, check the main gear retract rod end spring for minimum compression of 0.08 inch. Insert the spring feeler gage fabricated in Step "m", as shown in Figure 202, in the knee contact surface of the main gear lift leg. Apply a force, as shown in Detail "F" of Figure 201, using a push-pull scale. Apply the force until the torque knee contact surface of the lift leg releases the 0.002-inch spring feeler gage. The reading on the push-pull scale should be 55 to 65 pounds. To increase tension, add washer (Part Number 100951S063XP) as required, between the inboard end of retract rod spring and end of retract rod.

p. With the main landing gear fully extended and the downlock in the locked position, check the rollers for free movement of 0.01 to 0.02 inch between the rollers and downlock block. If this clearance is not obtained, loosen the block retaining bolts and adjust to proper clearance. Torque the bolts to 90 to 100 inch-pounds. With the main landing gear fully retracted and the uplock in the locked position, repeat this procedure to check and adjust the clearance between the uplock block and rollers as shown in Detail "E" of Figure 201.

q. With main landing gear fully extended, adjust the downlock cable to a tension of 52-1/2 (+10 −0) pounds using tensiometer in the wheel well. Tension is adjusted at the outboard end of the cable. If sufficient adjustment is not obtained at the cable eye, additional adjustment may be made at No. 3 wing rib by moving the cable housing inboard or outboard.



Main Gear Deflection
Figure 202

NOTE

Clean the clamp threads (bolt and nut).

Apply a light coat of thread locking compound (36, Chart 207, 91-00-00) on the cable clamp threads. Immediately after applying thread locking compound, install downlock cable and cable clamp on uplock cable. The cable clamp must maintain a clearance of 0.10 to 0.15 inch between the cable clamp and cable pulley. Torque cable clamp assembly to 80 to 90 inch-pounds. After five to seven minutes, retorque cable clamp assembly to 80 to 90 inch-pounds.

s. With the landing gear fully retracted, the uplock in the locked position and the uplock block adjusted as in step "p" there shall be a minimum of 0.11 inch overlap of the uplock stop angle with the lift leg of the brace assembly (Figure 203).

t. With the main landing gear fully retracted and the uplock in the locked position, apply a force of 58 to 68 pounds to the uplock assembly as shown in Figure 204. Using a feeler gage, check that the uplock stop angle deflects a maximum of 0.002 inch away from the landing gear lift leg.

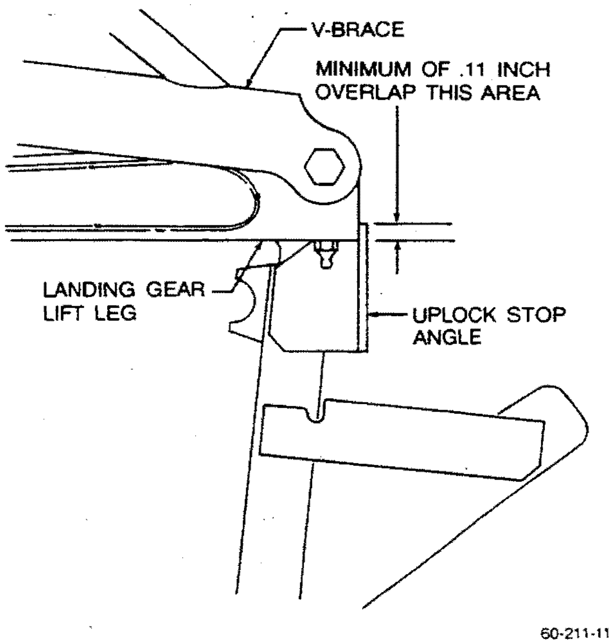
CAUTION

The uplock cable attach bolt must be installed with the bolt head aft. The bolt must be installed in this position to avoid interference between the bolt and the 49% stringer when the gear is fully retracted.

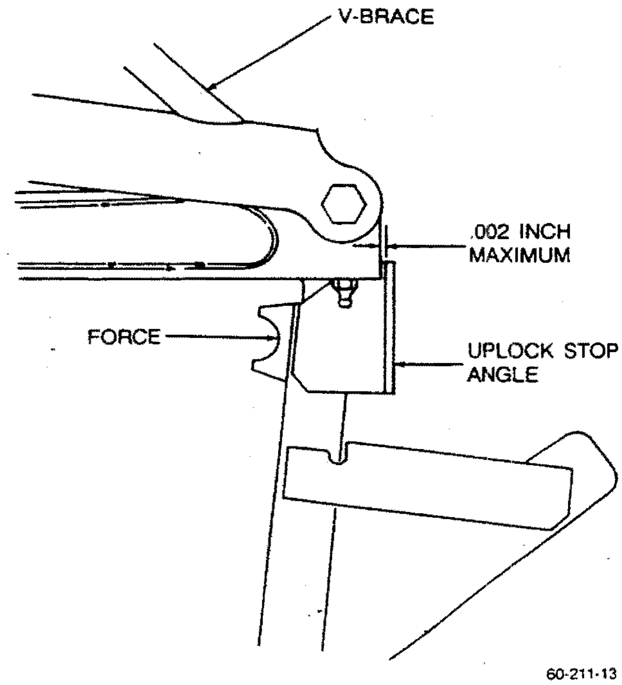
u. Extend the gear to approximately the 3/4 dow position and check for a minimum clearance of 0.50 inc between the tire and the inboard door at its closest poin while holding the door toward the tire.

v. Connect the outboard main gear door linkage an retract the gear slowly, checking to see that clearance i maintained between the door and gear. After checking t see that the door is not too tight, run the gear down an adjust the linkage as required. Continue this procedure unt a snug, firm fit is obtained when the door is completel closed.

w. Swivel the nose wheel to check the turning radiu of the strut for freedom of movement without binding c rough spots. Check the nose gear steering roller fc freedom of movement and the nose gear steering roller bo for security. Extend the gear to the full down position an



Uplock Stop Overlap
Figure 203



Uplock Deflection
Figure 204

make a preliminary adjustment on the down spring retaining nut located on the forward retract link to obtain a down spring length of 4.59 ± .030 inches (measure the forward spring retaining cap and the spring).

NOTE

Maintain a minimum spring length dimension of 4.56 inches (measure the forward retaining cap and the spring). Check that the spring does not stack or bottom out. Check to ascertain that the down spring is compressed a minimum of 1/8 inch when the gear is extended. Check that the bolts; or pins (serials P-153, P-155, P-163 through P-166, P-170 and after, and those serials P-4 through P-152, P-154, P-156 through P-162, P-167 through P-169 which have complied with Service Instructions No. 0460-212), through the slide tube are adjusted properly to allow the sleeve to slide on the tube.

CAUTION

If the nose gear down and lock light does not come on at landing gear extension at high air speeds, the length of the nose gear down spring should be readjusted to maintain a minimum compressed spring length of 4.59 ± .030 inches (measure the forward spring retaining cap and the spring). If unable to maintain proper down tension, the spring should be replaced.

x. Remove the access plate on the bottom side of the baggage compartment floor and disconnect the nose gear door linkage. Shorten the uplock linkage so the uplock will not interfere with nose gear stowage checks. Run the gear up slowly and check for clearance of the upper drag brace assembly to the baggage floor structure. Check the tire for proper clearance in the gear "up" position. The tire stows 1.0 inch above the closed gear door position. Adjust the front rod end on the forward retract rod as required to increase or decrease the tire clearance in the stowed position. Check for positive engagement of the uplock. Adjust the uplock for proper engagement. Extend the nose gear full down and check for compression of the forward retract rod plunger. Cycle the gear several times to ensure proper position. Check the down tension as follows:

1. Extend the gear to the full down position.
2. Move the lift leg joint just enough to insert a .002 inch feeler gage as shown in Figure 205 and return the gear to the full down position.

3. Apply a tension force downward at a 90° angle to the lift leg joint until the knee joint deflects just enough to allow movement of the feeler gage. The joint should deflect when a force of 60 ± 5 pounds is applied. If the down tension is not 60 ± 5 pounds, readjust the large spring retaining nut to obtain the correct down tension.

NOTE

Maintain a minimum spring length of 4.56 inches (measure the forward spring retaining cap and the spring).

y. Check that a clearance of .90 inch has been maintained between the baggage compartment floor and the nose gear in the retracted position.

NOTE

A one inch thickness of artist clay may be used to check this dimension (see the NOTE following step "k").

z. Connect the nose gear door linkage. On airplanes prior to P-281, adjust the nose gear door linkage rods to maintain a slight tension on the doors in the retracted position. On airplane serials P-281 and after, a force of 10 to 16 pounds should be required to deflect the forward, inboard corner of each door .125 inch.

NOTE

To provide an attachment point for a spring scale, fabricate a hook which can be screwed into the holes provided in the nose gear doors, as shown in Detail "I" of Figure 201. These holes are located at the inboard end of the forward hinges.

aa. Check that the nose gear tire clears the right door by a minimum of .50 inch at its closest point.

NOTE

If the tire does not clear the RH gear door by a minimum of .50 inch, the center retract rod may be shortened to increase the clearance. However, a minimum of .20 inch clearance must be maintained between the forward retract rod arm and the baggage floor when the nose landing gear is full "up". This dimension may be checked using clay.

Replace the access plate on the bottom side of the baggage compartment. With the nose gear system rigged, a final check should be made of the main gear down tension, the uplock spring tension, door tension, and the up stowage clearance.

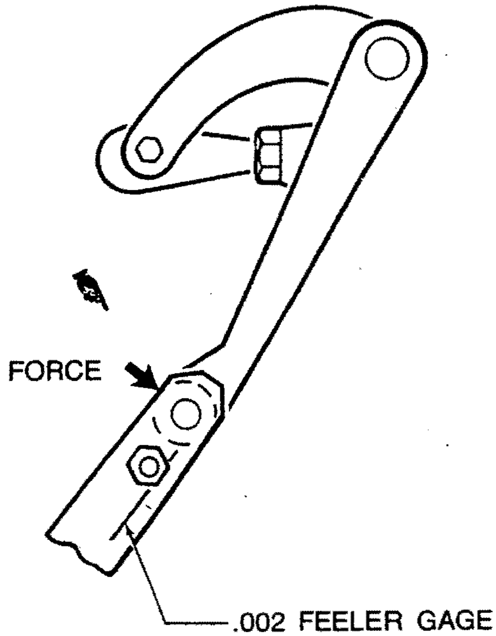
ab. Remove the wheel well access cover on the nose baggage compartment floor. With the landing gear retracted, adjust the uplock linkage until the uplock hook assembly has full engagement with the pin on the nose gear drag brace without deflecting the spring. After adjustment, extend the gear and safety the uplock link.

ac. With the gears down, check the adjustment of the safety switch. Refer to the Landing Gear Illustration, Figure 201, while adjusting the switch.

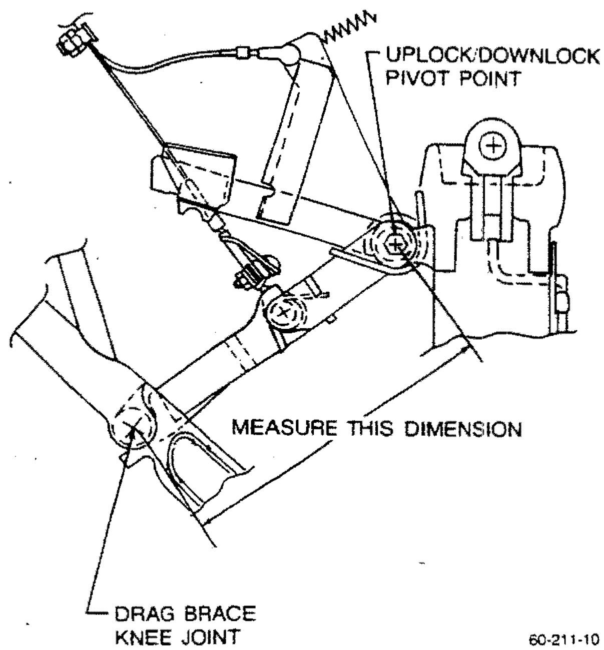
1. Remove the safety switch actuator rod (1) from the attaching bracket on the upper torque knee, then remove the retaining nut (2) and switch arm (3) from the switch shaft.
2. Jack the landing gear so the shock strut is compressed to .50 ± .12 inch from the extended position.
3. Connect the wire leads from a test light to pins inserted into the splices at wires number 1 and 3 (about 10 inches up from the safety switch).
4. Rotate the switch shaft clockwise until the test light comes on.
5. Remove the safety wire from the locking screw (4) on the switch arm (3) and back off the locking screw (4).
6. Install the switch arm (3) on the switch shaft in a position parallel to the upper torque knee and adjust the actuating rod end (1) to align with the attaching bracket on the torque knee. Install the actuating rod connecting bolt.
7. Position the shock strut to .87 ± .12 inch from the fully extended position and adjust the switch shaft counterclockwise at the adjusting screw (5) until the light goes out. When satisfactory adjustment is obtained, tighten the locking screw (4) and the retaining nut (2).
8. Recheck the landing gear travel to both dimensions described above before safety wiring the locking screw (4) to the switch arm.

ad. The landing gear position lights on the instrument panel are operated by uplock and downlock switches on each gear.

Main Gear: With the main landing gear fully extended, measure the distance between the uplock/downlock pivot



Nose Gear Deflection
Figure 205



Main Gear Downlock Switch Adjustment
Figure 206

points and the lift leg knee joint on the main landing gear as shown in Figure 206. Adjust the downlock switch (outboard side of gear) to actuate the in-transit light when the lift leg knee joint overcenter dimension is reduced by .15 ± .10 inch. With the landing gear fully retracted, adjust the uplock switches (inboard side of gear) to actuate the in-transit light when the actuator lacks five handcrank revolutions of being hard against the internal stop of the actuator. Adjust the switch as follows:

1. Handcrank the actuator until the sector gear contacts the internal stop.

2. Back the sector gear off the internal stop, by five revolutions of the handcrank.

3. Adjust the in-transit light switch to actuate in this position.

Nose Gear: With the nose gear fully extended adjust the downlock switch, located on the nose gear drag brace, so that the overtravel of the switch plunger is .050 to .125 inch after the actuation of the switch. Remove the wheel well access cover on the nose baggage compartment floor to gain access to the uplock switch. With the nose gear fully retracted, adjust the uplock switch (adjacent to the uplock hook) to actuate when the landing gear actuator lacks seven handcrank turns of being hard against the internal stop of the actuator. Adjust the switch as follows:

1. Handcrank the actuator until the sector gear is against the internal stop.

2. Back the sector gear off of the internal stop, by seven revolutions of the handcrank.

3. Adjust the uplock switch to actuate at this position.

ae. Recheck the limit switch adjustment and remove the airplane from the jack.

100-HOUR INSPECTION

RETRACT MECHANISM - Check the retraction system for proper operation of all components through at least two complete cycles. Check for unusual noises and evidence of binding.

DOORS AND LINKAGE - Check door operation, fit, rigging, and security.

POSITION INDICATORS - Check for security and adjustment of switches; wiring for breaks, condition of insulation and loose connections; indicators for proper indication.

WARNING HORN - Check for proper operation.

DOWNLOCKS - Check the main and nose gear deflection, the downlock switch for security and adjustment.

SAFETY SWITCH - Check for security and proper operation.

ACTUATOR - Check for unusual noises, binding, proper rigging.

LIMIT SWITCHES - Check for security and proper adjustment.

EMERGENCY EXTENSION - Check the system for freedom of operation and positive engagement of the downlocks.

"END"

WHEELS AND BRAKES - DESCRIPTION AND OPERATION

MAIN WHEEL ASSEMBLIES

The Duke is supplied with either Goodrich or Goodyear 6.50 x 8 wheel assemblies. (See TIRES for sizes, types and serial efeectivity.)

The wheel consists of an inner and outer magnesium wheel half held together with bolts, washers and nuts. The washers are used beneath the nuts and bolt heads to prevent galling and stress concentration.

A packing in the groove of the wheel halves provides a seal against air pressure. Bearing cups, cone bearings and seals are installed in the hub area. The Goodrich wheel assemblies are provided with balance weights; while both halves of the Goodyear wheel assembly are dynamically balanced. Identification and instruction plates are attached to both wheel halves.

Screws and safety wire retain sixteen torque keys in the slots of the flange area of the Goodrich inner wheel half; while fourteen keyway liners are riveted in place on the Goodyear inner wheel half. The torque keys/keyway liners retain the lugs of the brake disc which rotate with the wheel when the brake and wheel are mounted on the landing gear axle.

The wheel assemblies are secured to the axles with bushings, washers, nuts and cotter pins.

NOSE WHEEL ASSEMBLY

The Duke is supplied with either a Goodrich or Goodyear 6.00 x 6 wheel assembly mounting a 15.00 x 6.00 x 6, 4 ply, type VI, tube type tire. The wheel consists of an inner and outer wheel half. Goodrich wheels are manufactured of aluminum alloy; while Goodyear wheels are of magnesium. Both halves are held together with bolts, washers and nuts. Washers are used beneath the nuts and bolt heads to prevent galling and stress concentration.

Bearing cups, cone bearings and seals are installed in the hub area. Identification and instruction plates are installed on each Goodrich wheel half; while adhesive data and warning plates are installed on the outer Goodyear wheel half.

The wheel assembly is secured to the axle with a bushing, washer, nut and cotter pin.

TIRES

The main wheel tires supplied on the Duke, serials P-4 through P-189 and P-191, were 6.50 x 8, 8 ply tubeless, rim inflated tires. Later serials P-190, P-192 and after, and the earlier serials which have complied with Service Instructions No. 0536-203, are supplied with 19.50 x 6.75 x 8, 10 ply tube type tires.

The nose wheel tire supplied on the Duke is a 15.00 x 6.00 x 6, 4 ply, type VI, tube type tire.

BRAKE ASSEMBLY

Goodyear wheel and brake assemblies were supplied on serials P-4 through P-168. The later serials, P-169 and after, are supplied with Goodrich wheel and brake assemblies.

Both brake assemblies are designed for use with MIL-H-5606 hydraulic fluid (13, Chart 207, 91-00-00) to withstand 550 to 600 psi operational pressure with zero psi back pressure.

The Goodyear brake contains two rotating brake discs, which are keyed to rotate with the wheel, a stationary disc, pressure plate and back plate which are attached to the brake housing. Braking action occurs when hydraulic pressure is applied to the five small pistsons in the brake housing which force the disc stack together, creating friction between the rotating discs and the stationary parts. The pistons are sealed against leakage with packings. Indicator pins are used to determine brake wear. The brake assemblies are interchangeable between right and left by changing the location of the bleeder adapter.

The Goodrich brake contains one rotating brake disc, which is keyed to rotate with the wheel, two carrier linings, a torque plate and three piston insulators which are attached to the piston housing. Braking action occurs when hydraulic pressure is applied to the three small pistons in the piston housing which force the carrier linings together, creating friction between the rotating disc and stationary parts. The pistons are sealed against leakage with preformed packings. The brake assemblies are interchangeable between right and left by changing the location of the bleeder adapter.

HYDRAULIC BRAKE SYSTEM

Dual braking (pilot and copilot) is standard on serials P-4 through P-45. On serials P-46 and after, dual brakes are optional. The following description and operation discusses the dual braking system.

The dual hydraulic brakes are operated by either depressing the pilots or copilots rudder pedal. A shuttle valve adjacent to each set of pedals permits changing of braking action from one set of pedals to the other. The depression of either set of pedals compresses the piston rod of the attached master cylinder. The hydraulic pressure resulting from the movement of the pistons in the master cylinder is transmitted through flexible hoses and fixed aluminum tubing to the brake disc assemblies mounted on each main landing gear. This pressure forces the brake pistons to press against the linings and disc(s) of the brake assembly. Upon release of pressure against the pistons, the brake disc(s) will have a tendency to drag against the stationary liners.

Dual parking brake valves are installed adjacent to the rudder pedals between the master cylinders of the pilot's rudder pedals and the wheel brake assemblies. After the pilot's pedals have been depressed to build up pressure in the brake lines, both valves can be closed simultaneously by pulling out the parking brake handle. This closes the valves and retains the pressure in the brake lines. The parking brake is released when the parking brake handle is pushed in and the pedals are depressed briefly to equalize the pressure on both sides of the valves, allowing them to open.

"END"

TROUBLESHOOTING
BRAKE SYSTEM

	TROUBLE		*PROBABLE CAUSE*		*REMARKS*
1.	Solid pedal and no brakes.	a.	Brake lining worn beyond allowable limit.	a.	Replace lining.
2.	Spongy brake.	a.	Air in system.	a.	Bleed brake system.
3.	Unable to hold pressure.	a.	Leak in brake system.	a.	Visually check entire system for evidence of leaks.
				b.	Check master cylinder seals, replace if scored
4.	Parking brake will not hold.	a.	Air in system.	a.	Bleed brake system.
		b.	Defective parking brake valve.	b.	Replace the valve.
5.	Brakes grab.	a.	Stones or foreign matter locking brake disc.	a.	Clean brake disc and lining.
		b.	Warped or bent disc.	b.	Replace disc.

"END"

WHEELS AND BRAKES - MAINTENANCE PRACTICES

MAIN WHEEL AND TIRE

The wheel and tire assembly is shipped from the factory completely assembled. The bearings are packed with the proper grease and may be installed as received.

NOTE

Extended storage of the lubricated bearings may require relubrication. If this is necessary, refer to the applicable Wheel and Brake Manual (P/N 98-32751 or 98-34998) for instructions.

Install the main wheel and tire assembly on the axle as follows:

a. Visually check the nut and axle for burrs and rough threads.

b. Apply Aeroshell 5 grease (38, Chart 207, 91-00-00) to the threads and all bearing surfaces.

c. Install the wheel and tire assembly with bushing, washer and nut.

NOTE

Make sure that the brake disc lugs engage the slots of the inner wheel half. Rotate the wheel while adjusting the axle nut to assure proper seating and check to see that there is no side motion.

d. While rotating the wheel, torque the axle nut to 250-300 inch-pounds to ensure that the bearings are properly seated, then back off the axle nut to zero torque.

e. While rotating the wheel, retighten the axle nut to 125-145 inch-pounds of torque in one continuous rotation before checking for alignment of the locking holes and installing the cotter pin.

f. If necessary, continue tightening the nut to the next available cotter pin position and install a new cotter pin.

MAIN WHEEL INSPECTION

On the fifth tire change after a new wheel has been installed, then on each third subsequent tire change up to a total of 20 tire changes and on each tire change thereafter, the wheel and tire should be removed from the airplane, disassembled, and inspected in accordance with the applicable vendor wheel and brake manual. Bolts should be magnafluxed for cracks or breaks, and the wheel halves should be dye-checked or fluorescent penetrant inspected.

The following inspections may be accomplished with the wheel on the airplane:

a. Inspect wheel half flanges for cracks and corrosion. Smooth minor abrasions, nicks and burrs with a fine file or emery cloth, removing as little metal as possible. Chemically treat and coat the surfaces as instructed in the applicable Wheel and Brake Manual.

b. Check for loose or missing bolts and nuts. Retighten or replace as necessary.

CAUTION

Wheels with loose or missing bolts should be removed from the airplane and fluorescent inspected for cracks.

c. Inspect for excessively worn or loose torque keys or keyway liners.

NOSE WHEEL AND TIRE

The wheel and tire assembly is shipped from the factory completely assembled. The bearings are packed with the proper grease and may be installed as received.

NOTE

Extended storage of the lubricated bearings may require relubrication. If this is necessary, refer to the applicable Wheel and Brake Manual (P/N 98-32751 or 98-34998) for instructions.

Install the nose wheel and tire assembly on the axle as follows:

a. Visually check the nut and axle for burrs and rough threads.

b. Apply Aeroshell 5 grease (38, Chart 207, 91-00-00) to the threads and bearing surfaces.

c. Install the wheel and tire assembly with bushing, washer and nut.

d. While rotating the wheel, tighten the axle nut to 250 to 300 inch-pounds torque to ensure that bearings are properly seated. Back off the nut to zero torque. While rotating the wheel, retighten the axle nut to 125 to 145 inch-pounds torque in one continuous rotation. Using a wrench, tighten the nut to the next cotter pin location and install a new cotter pin.

NOSE WHEEL INSPECTION

On the fifth tire change after a new wheel has been installed, then on each third subsequent tire change up to a total of 20 tire changes and on each tire change thereafter, the wheel and tire should be removed from the airplane, disassembled, and inspected in accordance with the applicable vendor Wheel and Brake Manual. Bolts should be magnafluxed for cracks or breaks, and the wheel halves should be dye-check or fluorescent penetrant inspected.

The following inspections may be accomplished with the wheel on the airplane:

a. Inspect wheel half flanges for cracks and corrosion. Smooth minor abrasions, nicks and burrs with a fine file or emery cloth, removing as little metal as possible. Chemically treat and coat the surface as instructed in the applicable Wheel and Brake Manual.

b. Check for loose or missing bolts and nuts. Retighten or replace as necessary.

CAUTION

Wheels with loose or missing bolts should be removed from the airplane and fluorescent penetrant inspected for cracks.

c. Inspect for excessively worn or loose torque keys or keyway liners.

TIRE VALVE - TUBELESS TIRES

To replace a valve core, use the standard extraction tool to unscrew the valve core. If the stem or its attaching parts require replacement, dismount and disassemble the wheel and tire in accordance with the instructions in the applicable Wheel and Brake Manual. Replace parts as necessary.

HYDRAULIC BRAKE SYSTEM

Brake system servicing is limited primarily to maintaining the correct fluid level in the reservoir. (Refer to Chapter 12-20-00.) The other requirement related to servicing involves inspecting the wheel brake assemblies for wear.

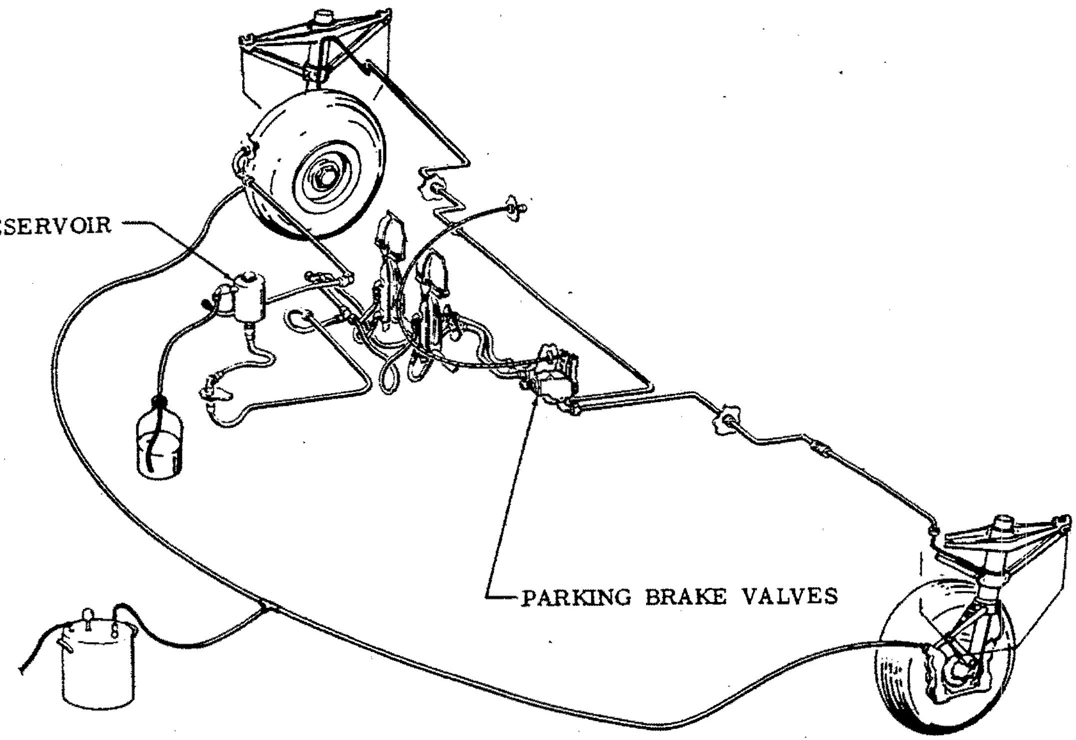
BRAKE SYSTEM BLEEDING

Brake system bleeding will be required whenever the system is opened at any point between the master cylinder and the wheel brake assembly, whenever the brakes become spongy in service, or wherever the parking brakes will no longer hold. In the latter instance, the system should be further checked for leakage.

Use only MIL-H-5606 hydraulic fluid (13, Chart 207, 91-00-00) in the brake system, and ensure that no dirt or foreign matter is allowed to get into the brake system. Dirt can get under seals and cause leaks or clog the compensating ports in the master cylinders and cause the brakes to lock.

Beech Aircraft recommends the use of pressure pot brake bleeding. If the pressure pot bleeding method is not avaliable, electric bleeding is recommended. Use the gravity method only if the other two methods are not available. If the gravity system is used, pressure bleed the brakes at the earliest possible time. Using any method, the parking brake lever and toe brake pedals must both be fully released to open the compensating ports in the brake master cylinders.

If the brakes feel soft or "spongy" after the bleeding operation, air may be trapped in the cylinders. Remove the brake and lay



Pressure Bleeding Brake System
Figure 201

it on its side. Add brake fluid as needed through the bleed port and tap the brake lightly with a rubber hammer to dislodge any air bubbles. When air bubbles no longer appear at the port, install the brake and repeat the bleeding procedure.

BRAKE SYSTEM PRESSURE BLEEDING

Pressure bleeding is the most efficient method of bleeding the brake system and is also the recommended method. This procedure involves attaching a pressure pot to the brake assembly bleeder ports and back bleeding the system to the fluid reservoir. Procedures for utilizing the preferred pressure pot, the electric bleeder and the gravity bleed method are outlined below.

Brake System Bleeding Using the Pressure Pot Method (Figure 201).

NOTE

The line hook-up for pressure pot bleeding is the same as shown in Figure 201 except the electric bleeder is replaced with a pressure pot.

a. Disconnect the pressure equalization line from the reservoir and attach an extension line approximately three feet in length.

b. Place the end of the extension line in a clean receptacle to collect the brake fluid overflow.

c. Cut the safety wire and remove the screws from the bleeder ports of each brake assembly. Install a bleeder hose adapter into each brake bleeder port.

Fabricate a bleeder hose assembly for each set of brakes; connect the bleeder hose assemblies between the bleeder hose adapters and the pressure lines of the pressure pot.

d. Apply a constant pressure of approximately 15 pounds to the pressure pot. Open the pressure pot control valve.

e. Bleed the system until the draining fluid is free of air bubbles.

f. Close the pressure pot valve. Remove the bleeder hose adapters and hose assemblies from each landing gear. Install the screws into the bleeder ports of each brake assembly and safety wire.

g. Remove the extension line from the pressure equalization port on the reservoir.

h. Connect the pressure equalization line to the reservoir.

i. Remove the cap from the hydraulic fluid reservoir and add MIL-H-5606 hydraulic fluid (13, Chart 207, 91-00-00) as required to obtain a full reading.

j. Check the operation of the brakes. There should be no soft or spongy feeling at the brake pedals and the pedal pressure should be equal on both brakes.

Brake System Bleeding Using the Electric Bleeder Method

a. Disconnect the pressure equalization line from the reservoir and attach the electric bleeder fluid return line to the reservoir.

b. Cut the safety wire and remove the screws from the bleeder ports of each brake assembly. Install a bleeder hose adapter into each brake bleeder port. Fabricate a bleeder hose assembly for each set of brakes; connect the bleeder hose assemblies between the bleeder hose adapters and the pressure lines of the pressure pot.

c. Activate the bleeder and set the relief valve to approximately 15 pounds; this may be ascertained by observing the pressure gage prior to opening the elec tric bleeder control valve.

d. Open the electric bleeder contro valve and observe the returning flui through the inline sight glass. Pumpin the pilot's and copilot's pedals durin the bleeding process may help to dislodg any air bubbles trapped in the maste cylinders.

e. When the returning fluid shows n further evidence of air bubbles, close th electric bleeder control valve.

f. Disconnect the fluid infusio lines from the bleeder hose assemblies an remove the bleeder hose assemblies an adapters from the brake assemblies Install the screws into the bleeder port of each brake assembly and safety wire.

g. Disconnect the fluid return lin from the brake fluid reservoir and reconnect the pressure equalization line.

h. Check the brake reservoir flui level and add MIL-H-5606 hydraulic flui (13, Chart 207, 91-00-00) as required t obtain a full reading.

i. Check the operation of the brakes When the brake pedals are depressed ther should be no spongy feeling and the peda pressure should be equal on both brakes.

Brake System Bleeding Using th Gravity Bleeding Method

This method of bleeding is done from th master cylinder down to the brake assembly. The brake fluid reservoir must b kept full during the bleeding operation Since the pilot's and copilot's maste cylinders are plumbed in series, th entire system may be bled by operating th pilot's brake pedals in the followin manner:

a. Cut the safety wire and open th bleeder port screws of both brake assemblies on one landing gear.

b. Depress the pilot's correspondin brake pedal slowly and smoothly to eliminate air trapped in the system.

c. Hold the brake pedal in the depressed position and close the bleeder port screws at the brake assemblies.

d. Release the brake pedal.

e. Repeat steps "a, b, c, and d" until no more air bubbles appear in the drained fluid.

f. Open the bleeder port screws of both brake assemblies on the other landing gear and repeat steps "a, b, c, and d", depressing the other brake pedal until no more air bubbles appear in the drained fluid.

g. Tighten the bleeder port screws at all four brake assemblies and safety wire.

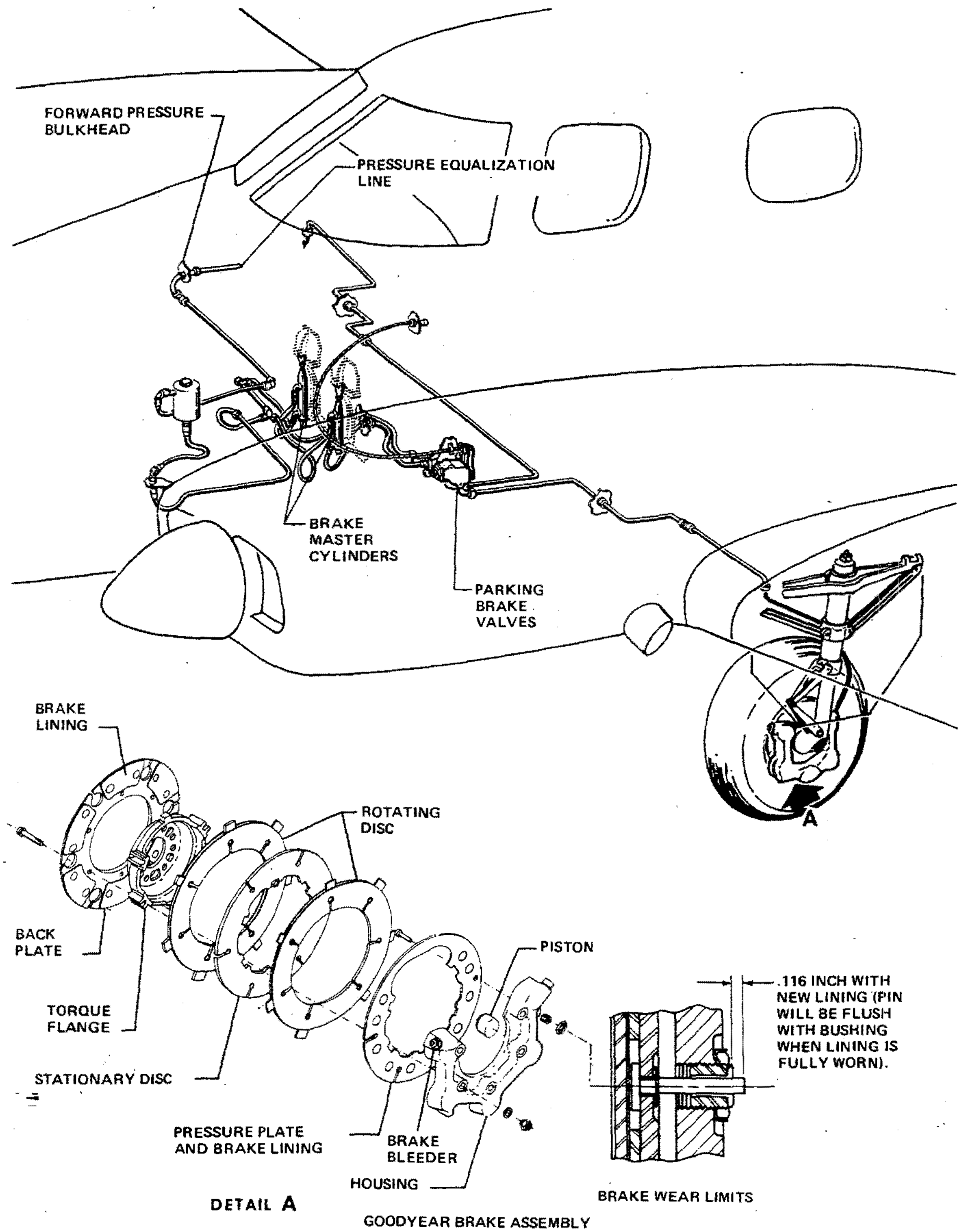
h. Check the brake reservoir fluid level and add MIL-H-5606 hydraulic fluid (13, Chart 207, 91-00-00) as required to obtain a full reading.

i. Check the brakes for proper operation. When the brake pedals are depressed there should be no spongy feeling and the pedal pressure should be equal for both brakes.

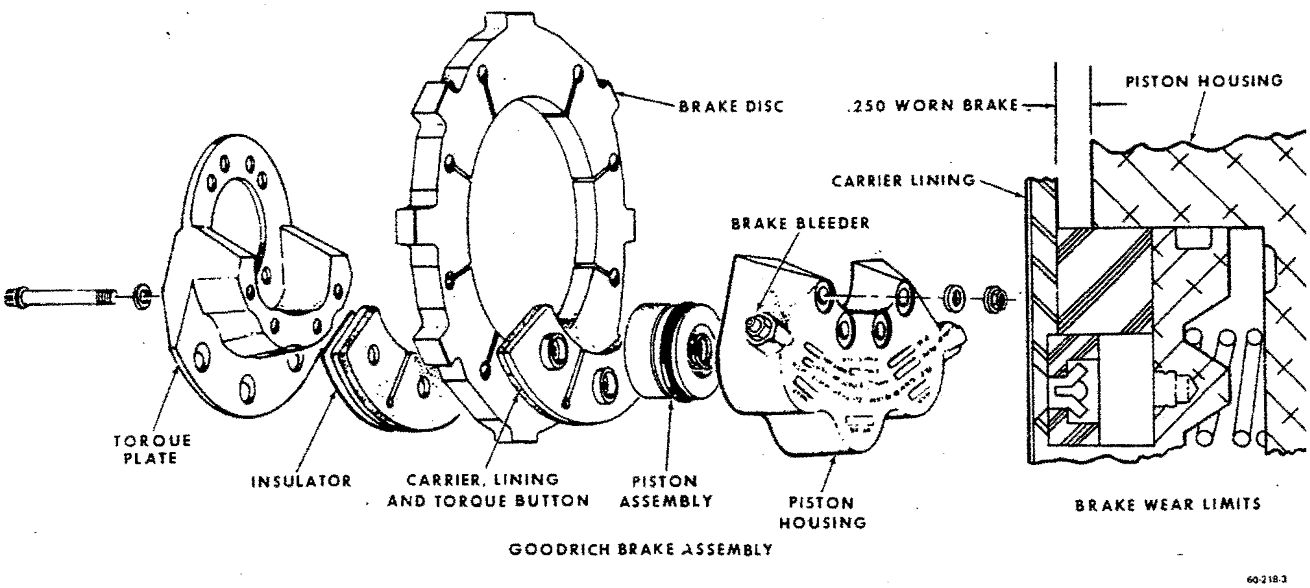
DUAL BRAKE SYSTEM BLEEDING

In airplanes having the optional dual brake system, the copilot's brake system is bled by closing the valve on the pressure pot and pumping the copilot's brake pedals to change the shuttle valve position. This causes hydraulic fluid to be routed through the copilot's system and this sytem should be bled as was the pilot's system.

After the pilot's and copilot's brakes have been bled, close the bleeder valve and repeat for the other wheel.



Brake System (Sheet 1 of 2)
Figure 202



Brake System (Sheet 2 of 2)
Figure 202

BRAKE ASSEMBLY REMOVAL (Figure 202)

a. Place the airplane on a jack.

b. Remove the cotter pin, wheel retaining nut, washer and bushing. Slide the wheel off the axle.

c. Disconnect the brake hydraulic line and cap the open line and port. Remove the bolts securing the brake housing to the landing gear torque flange. Slide the brake off the axle.

BRAKE ASSEMBLY INSTALLATION

a. Slide the brake assembly onto the axle and install the bolts attaching the brake housing to the landing gear torque flange. Tighten the bolts to 340 to 360 inch-pounds of torque.

b. Connect the brake hydraulic line.

c. Clean and repack the wheel bearings with Aeroshell 5 grease (38, Chart 207, 91-00-00) and slide the wheel on the axle. Install the bushing, washer and wheel retaining nut.

d. While rotating the wheel, tight the axle nut to 250-300 inch-pounds torq to ensure that bearings are proper seated.

e. Back off the axle nut to ze torque.

f. While rotating the whee retighten the axle nut to 125 to 1 inch-pounds torque in one continuo rotation.

g. Using a wrench, tighten the n to the next available cotter pin positi and install a new cotter pin.

h. Bleed the brake system.

BRAKE WEAR LIMITS (GOODYEAR)

A brake wear indicator pin is attach to the pressure plate on each brake. T pin moves with the pressure plate as t brakes are applied. When the brakes a applied and the indicator pin is flu with its bushing, the lining has reach its wear limit. The indicator pin wi measure 0.116 inch above the top of t its wear limit. The indicator pin will measure 0.116 inch above the top of the bushing when new brake linings are installed and the brakes are applied.

BRAKE WEAR LIMITS (GOODRICH)

If a measurement of .250 inch or more is noted between the piston housing and carrier lining, the brake assembly requires a lining inspection. If the carrier and lining thickness is under .180 inch, the brake assembly should be overhauled in accordance with the Wheel and Brake Manual (P/N 98-34998).

BRAKE MASTER CYLINDER REMOVAL

a. Close the parking brake valve by placing the control in the ON position.

b. Unsnap the floor mat and remove the floorboard section below the brake pedals.

c. Disconnect the two brake hydraulic lines at each master cylinder and mark the lines to assure correct reinstallation.

d. Remove the master cylinder attaching bolts and nuts and remove the master cylinder.

e. If new master cylinders are to installed, note the positions of the master cylinder 45-degree elbow fittings.

BRAKE MASTER CYLINDER INSTALLATION

a. Install the master cylinder with attaching bolts and nuts.

b. Connect the two brake hydraulic lines at each master cylinder as noted during removal.

c. Install the floorboard and the foor mat.

d. Open the parking brake valve by placing the control in the OFF position.

e. Service the brake reservoir and bleed the brake system.

BRAKE MASTER CYLINDER LINKAGE ADJUSTMENT

The proper linkage arrangement will adjust the brake pedals to a straight upright position. This is considered the best adjustment since it will prevent the pedals from hitting the bulkhead in their extreme forward position. Linkage adjustment is obtained by removing the clevis from the rudder pedal and turning the clevis on or off the piston rod as required. After both pistons are adjusted to the same length, tighten the jam nuts.

PARKING BRAKE VALVE REMOVAL

a. Bleed the brake system of all hydraulic fluid.

b. Remove the floorboards forward of the pilot's and copilot's seats.

c. Disconnect the parking brake cable from the parking brake valve by loosening the set screw and pulling the cable free of the cable attach fitting.

d. Disconnect and cap the hydraulic lines from the parking brake valve.

e. Remove the attach bolts and remove the valve.

PARKING BRAKE VALVE INSTALLATION

a. Install the parking brake valve with the attaching bolts.

b. Connect the hydraulic lines to the valve.

c. Connect the parking brake cable to the valve by engaging the cable to the attach fitting ad tightening the set screw.

d. Install the floorboards forward of the pilot's and copilot's seats.

e. Service the hydraulic reservoir and bleed the brake system.

PARKING BRAKE ADJUSTMENT

a. Place the parking brake control in the off (valve open) position.

b. Remove the floorboards forward of the pilot's seats.

c. Loosen the set screw in the cable attach fitting and adjust the cable housing through the mounting block to obtain 1-1/2 inch travel between the cable housing and the cable attach fittings. The 1-1/2 inch clearance should be made with the parking brake valve lever in the open position.

d. Tighten the mounting block, insert the cable in the cable attach fitting, tighten and safety wire the set screw in the attach fitting.

e. Test the parking brake adjustment by pulling the parking brake handle out and operating the brake pedals.

f. If the brake pedals are not solid, place the parking brake control in the off position and recheck the rigging.

g. Inspect the parking brake valve for hydraulic fluid loss.

100-HOUR INSPECTION

WHEELS AND TIRES

a. Visually inspect wheels for cracks, nicks and general condition.

b. Check the wheels for loose or missing parts.

c. Inspect tires for breaks, blisters and excessive wear.

d. Check tires for proper inflation as instructed in Chapter 12-20-00.

NOTE

In service, the tire grows slightly due to shock loads during landing. Normally, this growth is balanced by tread wear so there is no increase in tire diameter.

NOTE

The use of recapped tires is not recommended by Beech Aircraft Corporation. The tires may pass the retraction test when first installed; however, recapped tires have a tendency to swell after use and may cause malfunction of the retract system or damage to the landing gear doors.

BRAKES

Check brake discs, linings and lines for wear, corrosion and security, brake housing, valves and lines for leakage.

"END"

STEERING - MAINTENANCE PRACTICES

Direct linkage to the rudder pedals allows the nose wheel to turn 15° each side of neutral position. Spring mechanisms in the linkage dampen excessive shock loads to the rudder pedals. When the landing gear is retracted, the nose wheel is automatically centered.

Friction of the nose wheel against the ground, while the airplane is static, inhibits the turning movement. Proper turning may be accomplished smoothly by allowing the airplane to roll and lightly depressing the appropriate rudder pedal.

ADJUSTMENT

a. With the airplane on jacks, turn the nose wheel as far to the left as the rudder pedal will permit. Check for a 15° travel from neutral position. If proper travel is not obtained, proceed as follows:

1. Disconnect the nose steering linkage at the nose steering bell crank.
2. Loosen the jam nut and thread the rod end in or out, as necessary, to obtain the proper travel.
3. Tighten the jam nut and connect the steering linkage to the bell crank.

b. Adjust the shimmy damper as follows:

1. Disconnect the shimmy damper at the steering yoke.
2. Turn the nose wheel as far to the left as the rudder will permit.
3. Adjust the shimmy damper piston to extend 1/16 to 1/4-inch beyond the attach point on the steering yoke.
4. Connect the shimmy damper to the steering yoke and tighten the jam nut on the piston rod.

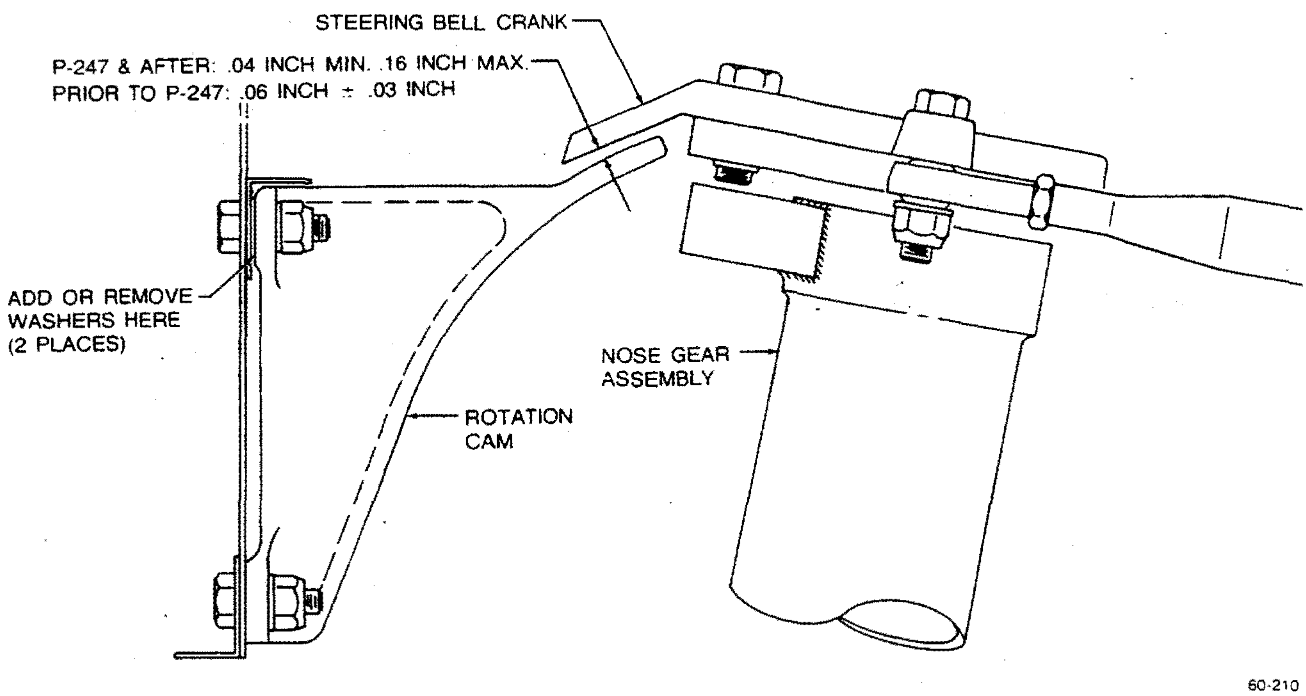
c. Adjust the steering bell crank clearance as follows:

1. Refer to Figure 201 and check the clearance between the bell crank and the rotation cam with the steering bell crank turned as far to the left and right (normal steering) as the rudder pedals will allow. Airplane serials prior to P-247 should have a clearance of .06 ± .03 inch. Airplane serials P-247 and after should have a clearance of .04 inch minimum and .16 inch maximum. Check the clearance with the bell crank in both the left and right positions.
2. If the clearance is other than the noted dimensions, AN960-416 or AN960-416L washers may be removed or added behind the rotation cam as required to maintain the correct clearance (refer to Figure 201). Up to a maximum of two AN960-416 and a maximum of four AN960-416L washers may be placed behind the rotation cam (2 places)

100-HOUR INSPECTION

STEERING LINKAGE - Check nose steering mechanism for condition, security and correct adjustment.

NOSE GEAR STEERING - Check the steering bell crank for cracks, condition, security and correct clearance.



Steering Bell Crank Clearance
Figure 201

"END"

POSITION AND WARNING - MAINTENANCE PRACTICES

SAFETY SYSTEM

No maintenance is required for the landing gear safety system, other than replacing defective units or checking the electrical wiring for condition, security of attachment, and tightness of electrical connections. The switches are preset and adjustment will not normally be required; however, should the system fail to function properly, the following checks and adjustments may be accomplished:

CHECK OF SYSTEM WITH SAFETY SWITCH IN TEST POSITION

a. Place the throttle in the closed or retarded position.

b. Place the battery master switch ON. The landing gear circuit breaker may be either in or out.

c. Place the landing gear safety system switch in the momentary full up (TEST) position. Noise or movement of the solenoid in the landing gear position switch indicates that the automatic landing gear extension part of the system is functioning properly. The on-off switch returns normally to the ON position unless the pilot intentionally places the switch in the OFF position.

MICROSWITCH ADJUSTMENT

The microswitch cannot be accurately adjusted on the ground. Before the microswitch is adjusted, it must be ascertained that the throttle warning horn switch is properly set. The microswitch may then be adjusted as follows:

a. With the airplane in flight, mark the throttle control at the control console when the manifold pressure gage registers approximately 17 ± 1 in. Hg.

b. With the airplane on the ground, move the throttle until the mark on the control is aligned with the control console as accomplished in step "a".

c. Adjust the microswitch until the cam clicks the switch closed with the throttle in the position indicated in the preceding step.

PRESSURE SWITCH ADJUSTMENT

The pressure switches are preset and will not normally require adjustment. Because of the built-in tolerance of these switches, they should not be tampered with unless the switch in question fails to actuate at an airspeed within 2 knots above or below the setting recommended for it. Even then the system plumbing and electrical wiring should be checked to ascertain that the source of trouble is not something other than improper adjustment of the pressure switches.

a. Place the airplane on jacks.

b. With the master switch ON, the landing gear circuit breaker in, and the landing gear warning circuit-breaker out, advance the throttle to its maximum position.

c. Place the landing gear safety position switch in the ON position.

d. Place the landing gear position switch in the UP position.

e. Clamp a section of soft rubber tubing over the pitot head inlet, making certain that the connection is airtight.

f. Crimp the end of the tubing and roll it up until the airspeed indicator registers 85 ± 2 knots. The landing gear will start retracting immediately if the pressure switch is properly adjusted.

CAUTION

To avoid rupturing the diaphragm of the airspeed indicator, the rubber tubing must be rolled SLOWLY.

g. If the landing gear failed to retract in the preceding step, turn the master switch OFF and adjust the pressure switch (outboard switch of the two installed in the left main wheel well) as follows:

1. Secure the rolled up tubing so that it will hold the airspeed indicator reading at 85 ± 2 knots.

2. Connect a continuity tester across the contacts of the pressure switch, then turn the adjustment screw until the switch closes at 85 ± 2 knots on the airspeed indicator.

h. Turn the master switch ON and roll up the rubber tubing until the airspeed indicator registers 130 kts. (to allow the switch to reset), then secure the tubing so that the airspeed indicator will hold that reading.

i. Retard the throttle.

j. Slowly bleed off pressure, until the airspeed indicator registers 120 ± 2 knots. The landing gear will extend immediately if the pressure switch is properly adjusted.

k. Should the landing gear fail to extend, turn the master switch OFF and adjust the pressure switch (inboard switch of the two installed in the left main wheel well) as follows:

1. Secure the rolled tubing so that it will hold the airspeed indicator reading at 120 ± 2 knots.

2. Connect a continuity tester across the contacts of the pressure switch, then turn the adjustment screw until the switch closes at the 120 ± 2 knots reading on the airspeed indicator.

I. Turn the master switch ON and check the landing gear safety system through the complete cycle of operation.

LANDING GEAR LIMIT SWITCHES - ADJUSTMENT

a. When adjusting the landing gear limit switches, observe the following precautions.

1. Do not allow the actuator to run full cycle into the internal stops as this may damage the sector gear. Adjust the limit switches for an early shut-down if this is considered a possibility.

2. Do not reverse the landing gear direction of travel without bringing the gear to a complete stop. If the direction of travel is reversed using the landing gear selector switch, damage to the sector gear may result.

3. Use the landing gear relay circuit breaker to start or stop the landing gear during rigging.

4. Battery voltage is not sufficient to properly cycle the landing gear during rigging. A 28.25 ± .25 volt auxiliary power unit capable of maintaining the initial setting within .25 volt during the extension and retraction cycles is recommended.

5. Do not operate the landing motor without proper cooling as this may damage the motor. Allow 5 minutes cooling time after each extension and retraction cycle.

6. After making an adjustment to the limit switches, operate the landing gear intermittently as the system nears the limits of the extension/retraction cycle to prevent damage due to overtravel.

7. Do not jack the airplane if an unbalanced condition exists. The fuel should be evenly distributed in the wings.

b. Adjust the landing gear limit switches as follows:

1. Place the airplane on jacks. Allow adequate floor clearance for the wheels during the retraction or extension cycle.

NOTE

The actuators (used on serials P-577 and after) may be installed on earlier airplanes. The new actuator is identified by part number 60-810030-5 or -7 and white paint on the upper actuator arm, and on the upper and lower actuator housing.

2. Retract the landing gear to its 2/3 position, then stop and inch the gear the remaining distai to the uplimit switch by intermittent operation of the land gear relay circuit breaker. Check the emergency hand cr for 1/8 to 1/4 turn (or 5/8 to 3/4 turn on airplanes using 810030-5 or -7 white actuators) free counterclockw movement before the sector gear contacts the geart internal stop. If proper internal clearance is not obtain adjust the landing gear uplimit switch. Locate the land gear uplimit switch adjustment screw on the actuator and adjust the screw to stop the landing gear on its up cy at the point where proper internal clearance is maintain

CAUTION

The gearbox may be damaged if allowed to run full cycle into the internal stops. To preclude this possibility, the limit switches should initially be adjusted aft, for an early shut-down, if an out-of-adjustment condition is suspected.

NOTE

All adjustment and rigging of limit switches should be accomplished using an external power source adjusted to 28.25 ± .25 volt. Due to overtravel, the landing gear will not stop at the same position that the limit switches are actuated.

NOTE

On series P-139 and after, there are two switch assemblies, one on each side of the actuator.

3. Extend the landing gear to its 2/3 dc position, then stop and inch the gear the remaining distai to the downlimit switch by intermittent operation of landing gear relay circuit breaker. Check the emerge hand crank for 1/8 to 1/4 turn counterclockwise (5/8 to turn with 60-810030-5 or -7 white actuators) before sector gear contacts the gearbox internal stop. If pro internal clearance is not obtained, locate the landing g downlimit switch adjustment screw on the upper arm of

landing gear actuator, and adjust the screw to stop the landing gear on its down cycle at the point where proper internal clearance is achieved.

WARNING

Do not operate the hand crank with the power on.

4. Extend and retract the gear two or three times to assure that the switches are correctly set. Check the hand crank each time to assure a free movement of 1/8 to 1/4 turn (5/8 to 3/4 turn on airplanes using 60-810030-5 or -7 white actuators) before the sector gear contacts the internal stop.

LANDING GEAR SAFETY SWITCH ADJUSTMENT

With the gear down, check the adjustment of the safety switch. Refer to the Landing Gear Illustration Figure 201 in 32-30-00, while adjusting the switch.

a. Remove the safety switch actuator rod (1) from the attaching bracket on the upper torque knee, then remove the retaining nut (2) and switch arm (3) from the switch shaft.

b. Jack the landing gear so the shock strut is compressed to .50 ± .12 inch from the extended position.

c. Connect the wire leads from a test light to pins inserted into the splices at wires number 1 and 3 (about 10 inches up from the safety switch).

d. Rotate the switch shaft clockwise until the test light comes on.

e. Remove the safety wire from the locking screw (4) on the switch arm (3) and back off the locking screw (4).

f. Install the switch arm (3) on the switch shaft in a position parallel to the upper torque knee and adjust the actuating rod end (1) to align with the attaching bracket on the torque knee. Install the actuating rod connecting bolt.

g. Position the shock strut to .87 ± .12 inch from the fully extended position and adjust the switch shaft counterclockwise at the adjusting screw (5) until the light goes out. When satisfactory adjustment is obtained, tighten the locking screw (4) and the retaining nut (2).

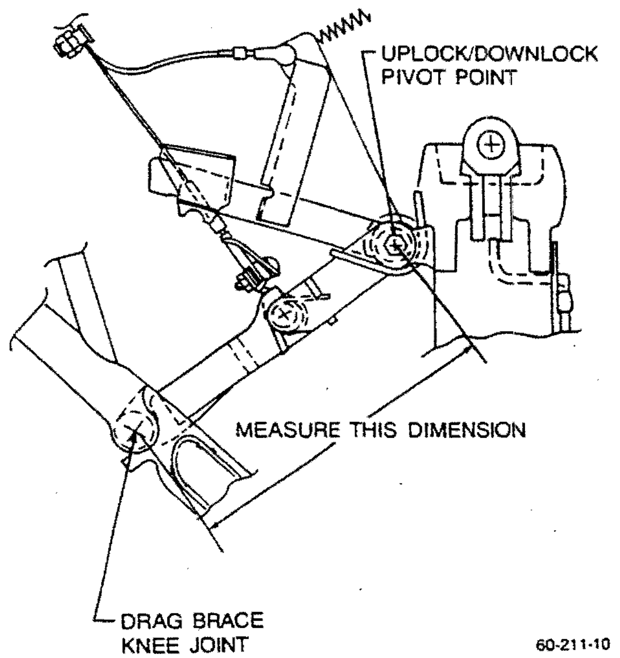
h. Recheck the landing gear travel to both dimensions described above before safety wiring the locking screw (4) to the switch arm.

LANDING GEAR POSITION LIGHTS ADJUSTMENT

The landing gear position lights on the instrument panel are operated by the uplock and downlock switches located on each landing gear.

a. Main Gear: With the main landing gear fully extended, measure the distance between the uplock/downlock pivot points and the lift leg knee joint on the main landing gear as shown in Figure 201. Adjust the downlock switch (outboard side of gear) to actuate the in-transit light when the lift leg knee joint overcenter dimension is reduced by .15 ± .10 inch. With the landing gear fully retracted adjust the uplock switches (inboard side of gear) to actuate the in-transit light when the actuator lacks five handcrank revolutions of being hard against the internal stop of the actuator. Adjust the switch as follows:

1. Handcrank the actuator until the sector gear contacts the internal stop.



Main Gear Downlock Switch Adjustment
Figure 201

2. Back the sector gear off the internal stop, by five revolutions of the handcrank.

3. Adjust the in-transit light switch to actuate in this position.

b. Nose Gear: With the nose gear fully extended adjust the downlock switch, located on the nose gear drag brace, so that the overtravel of the switch plunger is .050 to .125 inch after the actuation of the switch. Remove the wheel well access cover on the nose baggage compartment floor to gain access to the uplock switch. With the nose gear fully retracted, adjust the uplock switch (adjacent to the uplock hook) to actuate when the landing gear actuator lacks seven handcrank turns of being hard against the internal stop of the actuator. Adjust the switch as follows:

1. Handcrank the actuator until the sector gear is against the internal stop.

2. Back the sector gear off of the internal stop by seven revolutions of the handcrank.

3. Adjust the uplock switch to actuate at this position.

"END"

CHAPTER 33

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	202	Apr 18/80
	203	Apr 18/80
	204	Apr 18/80

CHAPTER 33 - LIGHTS

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"END"

GENERAL - DESCRIPTION AND OPERATION

HIGH INTENSITY LIGHTS - HOSKINS

The high intensity light system greatly increases the visibility of the airplane to other airplanes during night flight by means of pulsating strobe lights mounted adjacent to the wing tip and tail lights. The system is actuated by a switch in the exterior lighting group on the pilot's subpanel and is protected by a 10 amp circuit breaker on the copilot's circuit breaker panel. The strobe lights are powered by the master power assembly mounted in the aft fuselage directly behind the access door in the belly of the airplane. This assembly consists of three power supply modules (one for each strobe light) and a timing circuit module mounted on a common, negatively ground subchassis. The timing circuit module contains a small DC motor that rotates a notched transistorized power pack cam to actuate two switches mounted 180 degrees apart. Each time one of the switches is actuated, a relay in the affected power supply module closes to trigger its respective strobe light. A transistorized circuit in the power supply unit steps up the voltage of the airplane electrical system to the level (450 volts) required to operate the strobe light. The stepped-up voltage is stored in a condenser until released to the strobe light by the timer. The current from the power supply assembly is conducted to the flash tube of the strobe light by a specially shielded power cable. A charge of high voltage electricity is momentarily released to a coil in the flash tube assembly. The coil further steps up the charge to the point where it ionizes the xenon gas in the flash tube. The high voltage stored in the condenser then surges through the gas to produce the brilliant burst of energy that characterizes the strobe light.

HIGH INTENSITY LIGHTS-GRIMES AND SYMBOLIC DISPLAYS INC.

The function of the Grimes and SDI Strobe Light Systems are essentially the same as the Hoskins Strobe Light System. The Grimes and SDI systems do not incorporate a timing circuit, as the lights all flash at the same time. An electronic power supply module steps up the voltage of the airplane system to the level required to ionize the xenon gas in the flash-tubes. Each module contains a built-in flasher and the unit receiving input power acts as a master unit. An interconnecting unit located on the sides of each unit handles the input power and trigger pulsing of the system: these snap together when the units are placed side by side.

"END"

TROUBLESHOOTING
EXTERIOR LIGHTS

STROBE LIGHTS

TROUBLE		*PROBABLE CAUSE*		*REMARKS*
1. Lights inoperative.	a.	Circuit breaker tripped.	a.	Check for short circuit. Reset circuit breaker.
	b.	Loose connection.	b.	Check and tighten electrical connections.
	c.	Battery defective.	c.	Replace battery or use external power.
2. One bulb does not light.	a.	Bulb burned out.	a.	Replace bulb.
	b.	Fixture not grounded.	b.	Check for good bonding between fixture and structure. Tighten mounting screws.
	c.	Loose connection.	c.	Check all connections in circuit.
	d.	Defective fixture or switch.	d.	Replace fixture or switch.

LANDING LIGHTS

1. Lamp fails to light.	a.	Circuit breaker tripped.	a.	Check for short circuit. Reset circuit breaker.
	b.	Lamp burned out.	b.	Replace lamp.
	c.	Loose connection or defective.	c.	Tighten connections and check wire circuit continuity. Replace or repair wire if necessary.
	d.	Landing-light switch defective.	d.	Check continuity through switch. Replace if necessary.

"END"

EXTERIOR - MAINTENANCE PRACTICES

HIGH INTENSITY LIGHTS-HOSKINS

POWER CABLE CHECKS

a. Check that the individual conductors of the power cable are soldered to the connector pins as follows: red wire to the "A" pin, white wire (or striped wire of red and white) to the "B" pin, and black wire (or striped wire of red and black) to the "C" pin.

CAUTION

Failure to hook up the conductors and pins in this manner will result in extensive damage to both the light units and the power supply modules.

b. Use a 500 volt megger, check that the power cable resistance between the connector pins and between all the pins and ground (the cannon plug) is 15 megohms or greater.

c. Check the condition of the potting for the power supply cable at the terminals, connectors, and clamp cavities. The potting compound used to protect the system against moisture is RTV No. 102 silicon rubber.

d. Make sure the cable clamps are not tight enough to cause a short in the cable.

SYSTEM CHECK-OUT

The following check is recommended when the flash tube of a strobe light unit fails to fire:

a. Check that the flash tube is not broken and that the connectors are tight.

b. Disconnect the power cable from the inoperative light at the power supply module.

NOTE

To avoid the chance of shock through contact with the cable at the light fixture or with connector pins "A" and "B" at the power supply module, short out these pins to pin "C" (ground) to dissipate any residual charge left in the condenser after the system has been turned off.

Disconnect the power cable from one of the functioning lights and plug it into the power supply unit of the inoperative light. If the flash tube of the good light then fails to fire, the power supply unit has either failed or has a blown fuse.

CAUTION

Never place the power supply unit of the functioning light circuit into the circuit of the inoperative light, for a short in the defective circuit would then damage the functioning power supply unit.

A short in the power cable will normally blow a fuse in the power supply unit. Replace defective fuses only with those that have a three ampere rating.

CAUTION

Fuses with a higher capacity may permit operation of the power supply unit despite a short in the system, to the ultimate damage of the unit and related components.

POWER SUPPLY UNIT CHECKS

The most likely reasons for malfunctions of this unit are shorts in either the power cable or the lamp assembly, shorts caused by contact of the transistor case with a foreign object during operation of the unit, moisture in the connectors, and the buildup of excessive heat within the unit due to inadequate ventilation. When the system is operating properly, the action of the relays in each power supply unit can be heard. If the sound of these relays closing at the pulse rate of once per second cannot be heard, perform the timer check to ascertain that the cam is actuating the two switches properly. After 500 hours and 1000 hours of aircraft operation, perform the following check:

a. Open each power supply module and check the relay contacts for pitting. Replace those that are excessively pitted and clean the others.

b. Perform a capacitance check on the condensers by charging them to 450 volts DC and checking for leakage. Replace condensers whose leakage exceeds 1.5 milliamperes only with condensers obtained from the vendor (Hoskin Inc., 34 N. Bennett, Geneva, Illinois) or his authorized dealers. It should be noted that the foregoing capacitance check can be performed without removing the condensers from the power supply module.

CAUTION

To prevent short circuiting the system, avoid contact with the exposed transistors on the ends of the power supply modules.

TIMER MODULE CHECK

Remove the cover from the module and slowly rotate the motor mechanism so that the notched timing wheel between the two switches moves under the switch cam riders. A click should be heard as the rider touches bottom and another click as it reaches top. If necessary, loosen the top screw on the switch mounting plate and slide it in or out until the switches respond properly.

POWER SUPPLY UNIT REMOVAL

Remove the panel from the underside of the fuselage just aft of the rear pressure bulkhead to gain access to the power supply unit. This unit consists of three power supply modules (one for each light) and a timer module mounted on a common subchassis. The entire unit may be removed by disconnecting the wiring from the modules and removing the screws anchoring the subchassis to the support structure in the aft fuselage. Any one of the modules can be removed and replaced separately by simply disconnecting the wiring and removing the screws securing it to the subchassis.

CAUTION

If the exposed transistors on the end of each power supply unit are contacted during removal, the resultant damage will cause them to short out. Make sure the unit is hooked up as indicated in the wiring diagram, for it will be permanently damaged by reversed polarity.

POWER SUPPLY UNIT INSTALLATION

CAUTION

If the exposed transistors on the end of each power supply unit are contacted during installation, the resultant damage will cause them to short out. Make sure the unit is hooked up as indicated in the wiring diagram, for it will be permanently damaged by reversed polarity.

NOTE

A harness wring-out and high potential test of 500 vac on the harness wiring should be conducted on the strobe light harness in the wing and fuselage prior to connection of either the strobe light or strobe power supply.

Place the power supply module on the support structure and secure in place with the attaching screws. Connect the power supply module to the airplane wiring in accordance with the Wiring Diagram Manual (P/N 60-590001-29).

HIGH INTENSITY LIGHTS-GRIMES AND SYMBOLIC DISPLAYS INC.

POWER SUPPLY UNIT REMOVAL

Remove the panel from the underside of the fuselage just aft of the rear pressure bulkhead to gain access to the power supply unit. The entire unit may be removed by disconnecting the wiring from the power supply and removing the screws anchoring the modules to the support structure.

CAUTION

Observe the precautions noted under STROBE LIGHT WIRING procedure when removing the power supply.

POWER SUPPLY UNIT INSTALLATION

NOTE

A harness wring-out and high potential test of 500 vac on the harness wiring should be conducted on the storbe light harness in the wing and fuselage prior to connection of either the strobe light or strobe power supply.

a. Place the power supply module on the support structure and secure it in place with the attaching screws.
b. Connect the power supply module to the airplane wiring in accordance with the Wiring Diagram Manual (P/N 60-590001-29).

STROBE LIGHT WIRING

NOTE

A harness wring-out and high potential test of 500 vac on the harness wiring should be conducted on the strobe light harness in the wing and fuselage prior to connection of either the strobe light or strobe power supply.

An incorrect hook-up of the wires at either the power input or between the strobe light assemblies and the power supply unit will cause a reversal of polarity that results in serious component damage and failure. Care must be taken to ensure that the red wire is connected to positive power and the black wire to ground. On airplane serials prior to P-433 make sure that the red, white, and black wires are connected to pins "A", "B", and "C" of the connector respectively and that the connectors are properly assembled. On airplane serials P-433 and after make sure that the red, blue, and yellow wires are connected to pins "A", "B", and "C" of the connector respectively and that the connectors are properly assembled.

The shield for the wing cables should be grounded to the airplane structure at the wing break and the shield for the tail light cables should be grounded to the airplane structure at the power supply.

WARNING

Although a bleed-off resistor is incorporated in the power supply circuit, high voltage is involved in the circuit between the power supply and light assemblies. For this reason, turn the control switch for the strobe lights OFF and wait for at least 10 minutes to elapse before disconnecting the cables at the power supply or light assemblies and before handling or disassembling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.

STROBE LIGHT REPLACEMENT

CAUTION

To avoid damage to the strobe light system or possible physical injury from electrical shock, observe the precautions outlined under strobe light wiring before removing or installing the strobe light assembly.

CHART 201
LAMP BULB REPLACEMENT

LOCATION	*BULB PART NUMBER*
Annunciator Panel Lights	327
Edge Lights	D158-100-5T1
Post Lights	327
Compass Light	327
Instrument Flood Lights (Red)	1846R
Instrument Flood Lights (White)	1846
Map Light	1495
Flap Position Indicator Lights	FB-59
Landing Gear Position Lights	327
Reading Lights	1495
Threshold Light	313
Nose Baggage Compartment Light	303

CHART 201
LAMP BULB REPLACEMENT (Cont'd)

LOCATION	*BULB PART NUMBER*
Navigation Lights (Wing)	1524
Navigation Light (Tail)	1683
Rotating Beacon (Upper and Lower)	A7079B-24
Ice Light (P-4 thru P-402)	A7796A24
(P-403 and after)	A7079B-24
Landing Lights	4596
Taxi Light (Nose Landing Gear)	4587
Strobe Light, Tail (Flashtube) (Hoskins)	31-0725-1
Strobe Light, Tail (Flashtube) (Grimes)	55-0221-1
Strobe Light, Wing (Flashtube) (SDI)	202331
Strobe Light, Wing (Flashtube) (Grimes)	55-0221-1
Recognition Lights (Wing) (P-386, P-401 and after)	1982

"END"

CHAPTER 34

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CHAPTER 34 - NAVIGATION

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GENERAL - DESCRIPTION AND OPERATION

INSTRUMENT ACCESS

Engine instruments may be removed with the instrument panel in place. Pull the post-light shield straight off to provide clearance for the instruments. Loosen the retaining screw located below and to the left of the instrument, loosening the instrument retaining clamp. Sufficient wiring has been installed to enable you to pull the instrument out.

To gain access to the other instruments remove the four screws attaching the LH or RH panel door and pull it out far enough to disconnect plumbing and wiring, freeing the panel for removal.

NOTE

> To avoid marring the finish, wrap padding around the control columns just below the instrument panel.

The glare-shield may be loosened and tilted back by releasing the four clips located on the underneath side.

INSTRUMENT OPERATION

The gyro instruments operate on filtered air provided by the pneumatic pressure system. Adjustment of the pneumatic pressure system is performed by adjusting the various regulators in a specified sequence. A PRESSURIZATION SYSTEM ADJUSTMENT CHART corresponding to applicable illustrations and a general adjustment procedure for each individual regulator is provided in Chapter 36-00-00. The air speed indicator, altimeter, and rate-of-climb indicator operate on air provided by the pitot and static pressure system. (Refer to Chapter 34-10-00.)

An Overhaul and Replacement Schedule for instruments utilized by the Duke series aircraft is found in Chapter 5-00-00.

"END"

FLIGHT ENVIRONMENT DATA DESCRIPTION AND OPERATION

The pitot and static pressure system provides a source of ram and static air for instrument operation. Ram air enters the pitot tube, located on the LH lower side (P-4 through P-152) or the RH lower side (P-153 and after) of the nose section forward of the nose landing gear doors, and is routed to the pilot's airspeed indicator. A heating element is installed in the pitot mast to prevent the mast from becoming obstructed by ice. Static air is taken from a static air port, located on each side of the aft fuselage. The static air is routed along the right side of the fuselage to the cabin differential pressure gage, rate-of-climb indicator, altimeter and airspeed indicator. Should the normal static system become inoperative, an emergency static air source control, located on the upholstery panel forward of the copilot's seat, may be opened to provide a source of static air. The emergency air port is located on the aft pressure bulkhead. The drain valves are located on the RH lower upholstery panel.

NOTE

When dual instruments are installed an optional dual pitot and static system is utilized. The optional pitot mast is plumbed to the copilot's airspeed indicator. The optional static air ports are located, one on each side of the aft fuselage and are plumbed to the copilot's rate-of-climb indicator, altimeter and airspeed indicator.

"END"

TROUBLESHOOTING
PITOT AND STATIC PRESSURE SYSTEM

TROUBLE	PROBABLE CAUSE	REMARKS
1. Heating element inoperative.	a. Defective switch.	a. Replace.
	b. Grounded or open circuit.	b. Check for continuity.
	c. Defective heating element in pitot head.	
2. Circuit breaker keeps tripping.	a. Grounded wire.	
3. Instruments inoperative or erratic in operation.	a. Lines clogged.	a. Drain lines at emergency static drain. Disconnect lines at instruments and blow out with low pressure air.
	b. Line leaks.	b. Check lines for looseness at all connection points.

"END"

FLIGHT ENVIRONMENT DATA - MAINTENANCE PRACTICES

(Figure 201)

PITOT SYSTEM LEAK TEST

A functional test of the pitot system can be made by using an observer in the cabin to watch the airspeed indicator while air pressure is built up by using a section of soft rubber tubing as follows:

a. Clamp the rubber tubing over the pitot mast inlet, making certain that the connection is air tight.
b. Crimp the end of the tubing and slowly roll it up until the airspeed indicator registers approximately 90% of its maximum reading.

CAUTION

To avoid rupturing the diaphragm of the airspeed indicator, roll up the rubber tubing slowly and do not build up excessive pressure in the line.

c. Secure the rolled up tubing so that it will hold the airspeed indicator reading.
d. If there is no decline in the reading after several minutes, there is no leak in the pitot system.
e. If a decline in the reading of the airspeed indicator is observed, check the pitot system plumbing for leaky hoses and loose connections.

CAUTION

Release the air pressure slowly by unrolling the rubber tubing; a sudden release of the air pressure may damage the airspeed indicator.

PITOT SYSTEM HOSE INSPECTION

After the pitot system is checked for leaks, inspect the hose sections for signs of deterioration. Check all polyethylene tubing for hardness or brittleness. Rubber hoses on which outer surfaces have checked or cracked, particularly at the bends or connecting points, or which have become hard, should be replaced. Replace the defective hose with MIL-H-5593 rubber hose (27, Chart 207, 91-00-00). When new hose is installed, recheck the system for leaks using the PITOT SYSTEM LEAK TEST procedure.

STATIC SYSTEM CLEANING

Blow low air pressure through the lines from the disconnected line at the airspeed indicator to the static ports. Cover each static port separately when blowing to insure that each line is clear. Instrument error or possible damage may result if even one port is clogged with dirt or foreign matter.

CAUTION

Never blow air through the line toward the instrument panel; to do so will seriously damage the instruments. When blowing back through the line from the instrument panel, make sure that no air is blown into the instruments.

NOTE

Wax or polish applied to the static air buttons can cause wrong instrument readings. The static air buttons should be cleaned periodically with a cleaning solvent to insure that no film exists on them.

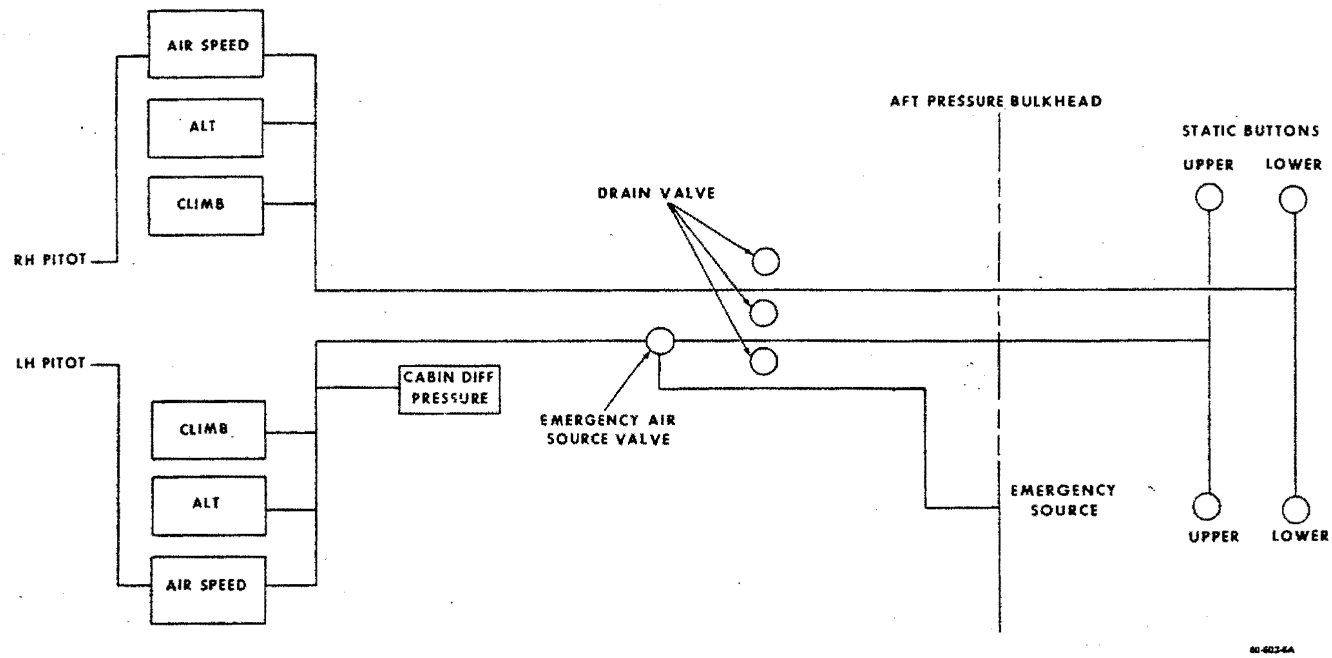
Drain the static air system by opening the static drain valves located on the upholstery panel forward of the copilot's seat.

STATIC SYSTEM LEAK TEST

The static system should be checked for leaks in accordance with the instructions in Federal Aviation Regulation 91.170.

CAUTION

To avoid damaging the airspeed indicators, the indicators should be removed from the system and the lines capped or an equal pressure should be applied to the pitot side of the indicators while leak testing the system.



Pitot and Static System Schematic
Figure 201

"END"

CHAPTER 35

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CHAPTER 35 - OXYGEN

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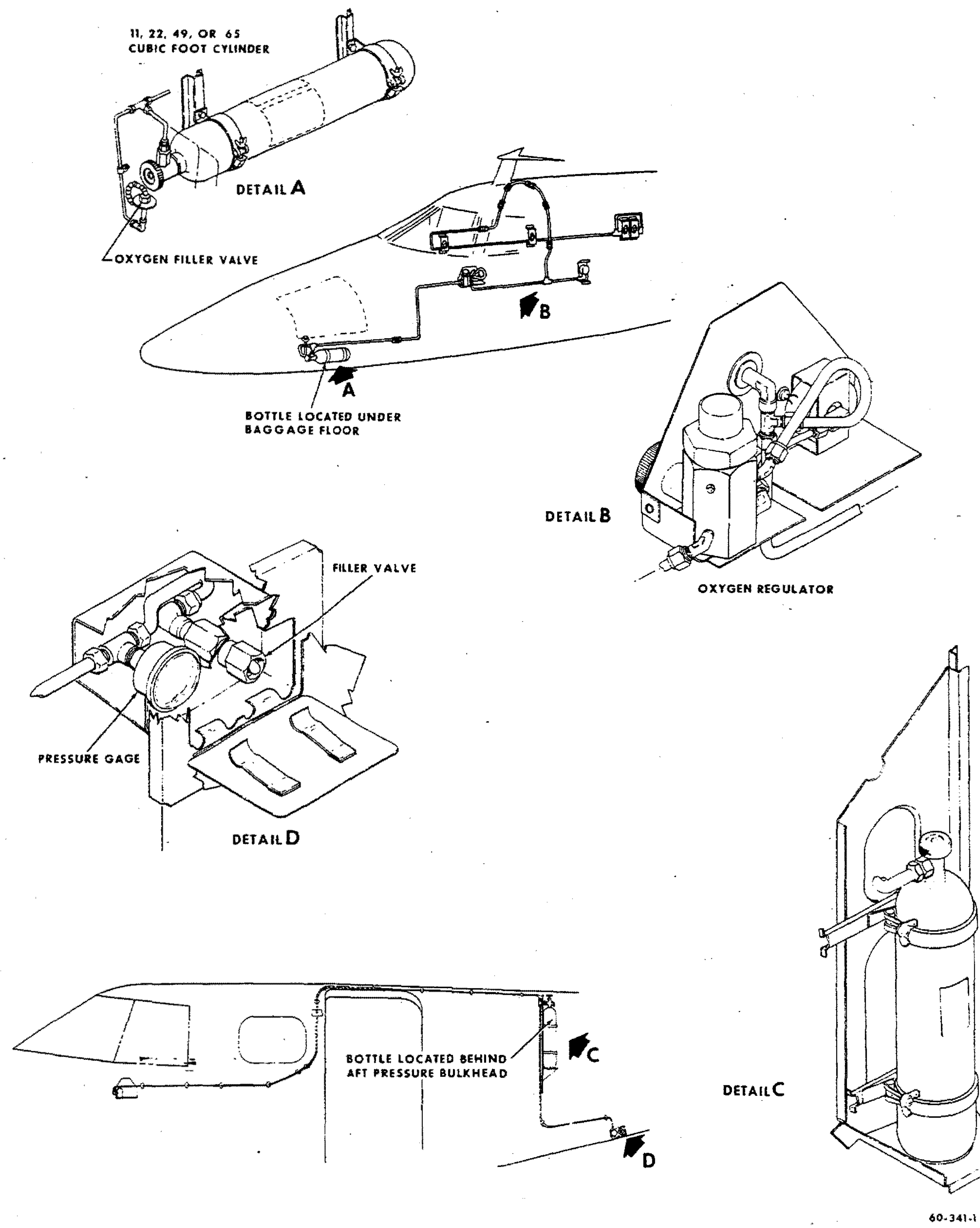
"END"

GENERAL - DESCRIPTION AND OPERATION

Oxygen for flights at high altitude is supplied by a cylinder mounted under the nose baggage compartment floorboards or aft of the rear pressure bulkhead. The system is serviced by a filler valve, accessible through a door on the lower LH side of the aft fuselage for the aft mounted bottle or the nose baggage compartment for the nose mounted bottle. A gage is mounted adjacent to the filler valve for checking system pressure during filling. Oxygen flows from the cylinder through a line to the regulator, pressure gage and shutoff valve in the oxygen panel located on the pilot's sidewall. These components regulate the oxygen flow to the six cabin wall outlets. Oxygen masks are of the Scott 283 continuous-flow type. They are easily adjusted to fit the average person comfortably with a minimum leakage of oxygen and are considered adequate for continuous use up to 30,000 feet. When use of the oxygen is discontinued, it is necessary that the system be turned off by closing the control valve of the console. The pressure gage on the console indicates the supply of oxygen available but does not disclose whether the system is on or off. The regulator is a pressure-demand altitude compensating constant flow type which reduces system pressure to 50 to 55 psi at the passenger outlets.

WARNING

Proper safety measures must be employed while using oxygen, or a serious fire hazard will be created. NO SMOKING PERMITTED.



Oxygen System
Figure 1

"END"

GENERAL - MAINTENANCE PRACTICES

CAUTION

All persons handling and servicing oxygen systems should review proper precautions to be observed during servicing. FAA Advisory Circular 43.13-1A contains the necessary information.

OXYGEN SYSTEM TEST PROCEDURES

Plug a pressure gage (0 to 100 psi range) into the pilot's or copilot's outlet. Note that the regulator is shut off and no pressure is indicated on the test gage. Charge the high pressure system to 1850 psi. Shut off the cylinder valve and observe the aircraft gage for evidence of leakage. The pressure loss in 5 minutes shall not exceed 400 psi. Check that there is no leakage past the regulator by observing the low pressure test gage. Turn on the high pressure supply and the regulator. Allow 2 minutes for the pressure to stabilize in the low pressure system, then turn off the regulator and note the pressure on the test gage. After 15 minutes, the drop in pressure shall not exceed 5 psi. In case leakage is excessive, apply MIL-L-25567 leak testing compound (14, Chart 207, 91-00-00) sparingly to suspected areas. Make necessary repairs and retest.

NOTE

A small quantity of oxygen under pressure is trapped in the control chamber of the regulator when the regulator is turned to OFF. This oxygen (50 to 70 cc) will continue to bleed overboard until the control chamber pressure equalizes with ambient pressure.

OXYGEN SYSTEM PURGING

Offensive odors may be removed from the oxygen system by purging. The system should also be purged any time system pressure drops below 50 psi or the lines are left open. Purging is accomplished by connecting a recharging cart into the system and permitting oxygen to flow through the lines and outlets until any offensive odors have been carried away. The following steps outline the procedures recommended for purging the oxygen system.

WARNING

Avoid making sparks and keep all burning cigarettes or fire away from the vicinity of the airplane when the outlets are in use. Inspect the filler connection for cleanliness before attaching it to the filler valve. Make sure that your hands, tools, and clothing are clean, particularly of grease or oil stains, for these contaminants will ignite upon contact with pure oxygen. As a further precaution against fire, open and close all oxygen valves slowly during filling.

a. After gaining access to the oxygen cylinder turn the oxygen cylinder valve toward the closed position until it is just cracked open.

b. Open the access panel for the filler valve, remove the protective cap, and attach the hose from an oxygen recharging cart to the filler valve.

c. Plug in an oxygen mask at each outlet in the cabin and pilot's compartment.

d. Open the cabin door, and turn the oxygen shutoff valve in the pilot's compartment to the open position.

e. Set the cart pressure regulator to deliver 50 psi of pressure to the system.

f. Allow the system to purge for one hour.

If any offensive odor still lingers, continue purging the system for an additional hour. If such odors still remain, replace the supply cylinder. After the system has been adequately purged, return the cylinder valve to its normal operating position and service the system as described in Chapter 12-10-00.

OXYGEN CYLINDER REPLACEMENT

WARNING

Avoid making sparks and keep all burning cigarettes or fire away from the vicinity of the oxygen cylinder. Make sure that your hands, tools, and clothing are clean, particularly with respect to oil or grease spots, for these contaminants will ignite upon contact with pure oxygen under pressure.

a. Slowly turn the oxygen supply cylinder valve until fully closed.

b. Disconnect the line from the supply cylinder.

c. Cap the open line immediately with a clean fitting.

d. Support the cylinder and then loosen the two bracket clamp wing nuts.

NOTE

Observe the special handling precautions on the tag attached to the oxygen cylinder.

e. Remove the old cylinder from the clamps and install the new cylinder.

f. Carefully inspect the fittings on both the cylinder and the line for cleanliness and the presence of foreign matter, since such matter may contaminate the oxygen until it is unfit for breathing.

g. Connect the line fitting to the cylinder.

h. Open the cylinder shutoff valve.

i. Test the connections for leaks with MIL-L-25567 leak testing compound (14, Chart 207, 91-00-00).

OXYGEN CYLINDER RETESTING

Oxygen cylinders used in the Duke series aircraft are of two types. Light weight cylinders, stamped "3HT" on the side plate, must be hydrostatically tested every three years and the test data stamped on the cylinder. This bottle has a service life of 4,380 pressurizations or fifteen years, whichever comes first, and then must be discarded. Regular weight cylinders, stamped "3A" or "3AA" must be hydrostatically tested every five years and stamped with the retest date. Service life on these cylinders is not limited.

"END"

CHAPTER 36

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CHAPTER 36 - PNEUMATIC

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"END"

GENERAL - DESCRIPTION AND OPERATION

The pressure system on the Duke provides filtered air for deicer, autopilot and gyro instrument operation. Air pressure is supplied by two engine-driven dry air pumps. Pressure is controlled by a supply pressure regulator located in each nacelle. From the supply pressure regulator, air then flows to the pressure manifold, located below the pilot's and copilot's floorboards. Air from the manifold is distributed to the instruments and the deicer and autopilot systems (if installed).

Pressure from the pressure manifold to the gyro instruments is regulated. On airplane serials P-3 through P-182, a single regulator is located on the RH side of the pilot's compartment, forward and below the instrument panel. The gyro instrument pressure may be monitored on the gyro instrument pressure gage. On airplane serials P-183 and after, the pilot's and copilot's gyro instrument supplies are separated and each is supplied by separate pressure regulators. These regulators are located near the manifold, below the RH floorboards, forward of the main spar. A selector valve is provided to permit monitoring the pilot's or copilot's gyro instrument pressures on the gage.

"END"

GENERAL - MAINTENANCE PRACTICES

SERVICING

Impurities and foreign matter are removed from the air by two separate filters before entering the pressure manifold. On serials P-3 through P-246 which have not complied with Service Instructions 0595-194 the intake filter, located forward of the rear engine baffle, should be removed and cleaned every 100 hours. The paper filter on serials P-247 and after cannot be cleaned and should be replaced every 300 to 500 hours or annually.

CAUTION

In the event the paper filter is contaminated by solvent it must be replaced.

The sealed inline filter on the pressure side of the pressure pump, located in each nacelle aft of the firewall, should be replaced every 150 hours of operation for serials P-3 through P-159 except P-158 and every 300 hours of operation for serials P-158, P-160 and after.

ADJUSTMENT

Adjustment of the pneumatic pressure system is performed by adjusting the various regulators in a specified sequence. A PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART corresponding to applicable illustrations and a general adjustment procedure for each individual regulator are provided on the following pages.

On serials P-158 and after and those prior airplanes which have complied with Part II of Service Instructions 0433-190 that are equipped with an H-14 autopilot and a surface deice system incorporate a normally open by-pass valve for the H-14 Autopilot pneumatic pressure regulator. The valve causes air to bypass the regulator except in the deice mode thus eliminating air pressure drop across the regulator and permitting a lower system operating pressure for increased air pump life.

SINGLE STAGE SUPPLY PRESSURE REGULATOR

The single stage supply pressure regulator is used when the basic pressure system or the basic with H-14 autopilot pressure system is installed. The regulator is located in the RH side of each nacelle, aft of the firewall. The regulator may be adjusted as follows:

a. Remove the cap from the supply pressure test point located in the pressure line between the regulator and the inline air filter.

b. Install a test gage (0-20 psi) on the supply pressure test point.

c. Loosen the check nut and adjust the supply pressure regulator to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART. The engine should be running at 2500 rpm while the adjustment is being made. Rotate the adjusting screw clockwise to increase pressure and counterclockwise to decrease pressure.

d. Tighten the check nut, remove the test gage and reinstall the cap on the test point.

e. Repeat the above procedure on the opposite side of the airplane.

TWO STAGE SUPPLY PRESSURE REGULATOR

The two stage supply pressure regulator is used when the basic with deicer pressure system or the basic with deicer and H-14 autopilot pressure system is installed. The regulator is located in the RH side of each nacelle, aft of the firewall. The regulator may be adjusted as follows:

a. Loosen the check nut on the low pressure section of the regulator (section with the cutout solenoid attached) and adjust to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART. The engine should be running at 2500 rpm and the deicer system turned off while the adjustment is being made. Rotate the adjusting screw clockwise to increase pressure and counterclockwise to decrease pressure.

b. Tighten the check nut on the low pressure section of the regulator.

c. Loosen the check nut on the high pressure section of the regulator (section without the cutout solenoid attached) and adjust to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART. The engine should be running at 2500 rpm and the deicer system turned on while the adjustment is being made. Rotate the adjusting screw clockwise to increase pressure and counterclockwise to decrease pressure.

d. Tighten the check nut on the high pressure section of the regulator.

e. Repeat the above procedure on the opposite side of the airplane.

EJECTOR REGULATOR (P-308 and after; EQUIPPED WITH SURFACE DEICE)

A regulator is installed in the supply line for the ejector which develops the vacuum used in the cabin pressurization system on airplane serials P-308 and after, if equipped with surface deice. This regulator may be adjusted by the following suggested procedure:

a. Remove the plug from the port adjacent to the regulator outlet port.

b. Connect a pressure gage to this port.

c. Operate one engine at a speed of 2500 rpm.

d. Loosen the check nut and adjust the regulator to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART. Monitor the outlet pressure on the test gage and the inlet pressure of the regulator on the pneumatic pressure gage. Turn the adjustment clockwise to increase the pressure, counterclockwise to decrease the pressure. Tighten the check nut.

e. Remove the test gage and replace the plug.

GYRO INSTRUMENT PRESSURE REGULATOR

The gyro instrument pressure supply is regulated on all configurations of the pressure system. On airplane serials P-3 through P-182, a single gyro instrument pressure regulator is used. This regulator is located on the RH side of the pilot's compartment, forward and below the instrument panel.

On airplane serials P-183 and after, a pair of gyro instrument pressure regulators are located below the RH floorboards of the pilot's compartment, just forward of the main spar. Access may be gained to these regulators by removing the carpet and an access panel. A selector valve on the subpanel permits switching the gyro instrument pressure gage to monitor either the pilot's or copilot's gyro instrument pressure.

GYRO INSTRUMENT PRESSURE REGULATOR ADJUSTMENT (P-3 thru P-182)

a. Loosen the check nut and adjust the regulator to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART. Both engines should be running at 2500 rpm while the adjustment is being made. Rotate the adjusting screw clockwise to increase pressure and counterclockwise to decrease pressure.

b. Tighten the check nut on the regulator.

GYRO INSTRUMENT PRESSURE REGULATOR ADJUSTMENT (P-183 and after)

a. Remove the carpet and the instrument air regulator access panel from the RH floorboards just forward of the main spar.

b. Operate both engines at 2500 rpm while the adjustment is being made.

c. Select the PILOT position of the selector valve to permit monitoring the pilot's gyro instrument supply pressure.

d. Loosen the check nut and adjust the regulator supplying pressure to the pilots gyro instruments. Adjust the regulator to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART, CHART 201. Rotate the adjusting screw clockwise to increase, counterclockwise to decrease the pressure.

e. Tighten the check nut on the regulator.

f. Select the COPILOT position of the selector valve.

g. Loosen the check nut and adjust the regulator supplying pressure to the copilot's gyro instruments.

h. Tighten the check nut on the regulator.

i. Shut down the engines.

j. Replace the access panel and carpeting.

TURN AND SLIP PRESSURE REGULATOR

A turn and slip pressure regulator is installed for each pressure-driven turn and slip indicator. The regulator is located on the turn and slip indicator forward of the instrument panel. The regulator may be adjusted as follows:

a. Remove the glareshield and/or radio panel to provide access to the back side of the turn and slip indicator.

b. Remove the plug on the upper side of the regulator and install a test gage (0-5 in. Hg).

c. Loosen the check nut and adjust the turn and slip regulator to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART. Both engines should be running at 2500 rpm while the adjustment is being made. Rotate the adjusting screw counterclockwise to increase pressure and clockwise to decrease pressure.

d. Tighten the check nut, remove the test gage and reinstall the plug in the regulator.

e. Reinstall the glareshield and/or radio panel.

H-14 AUTOPILOT PRESSURE REGULATOR

The H-14 autopilot pressure regulator is used only with the basic with deicer and H-14 autopilot pressure system. The regulator is located inside the tail section just aft of the aft pressure bulkhead (see Figure 207). Adjust the regulator as follows:

a. Remove the cap from the autopilot pressure test point and install a test gage (0-20 psi).

b. Loosen the check nut and adjust the regulator to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART. Both engines should be running at 2500 rpm while the adjustment is being made. Rotate the adjusting screw clockwise to increase pressure and counterclockwise to decrease pressure.

c. Tighten the check nut, remove the test gage and reinstall the cap on the test point.

CHART 201
PNEUMATIC PRESSURE SYSTEM ADJUSTMENT

	Single Stage Supply Pressure Regulator	Two Stage Supply Pressure Regulator	Gyro Instrument Pressure Regulator	Turn and Slip Pressure Regulator	Autopilot Pressure Regulator	Aileron Servo Pressure Regulator
Basic System. (Figure 201 and Figure 202)	$\boxed{1}$ 7.5 ± .5 psi * on test gage. Engine running at 2500 rpm. Adjust each side individually. **		$\boxed{2}$ 5.25 ± .25 inches Hg * on gyro pressure indicator. Both engines running at 2500 rpm. †††	$\boxed{3}$ 2.3 ± .2 inches Hg *** on test gage. Both engines running at 2500 rpm.		
Basic with H-14 Auto pilot (Figure 203)	$\boxed{1}$ 11.8 to 12.3 psi on test gage. Both engines running at 2500 rpm with autopilot on. †		$\boxed{2}$ 5.25 ± .25 inches Hg * on gyro pressure indicator. Both engines running at 2500 rpm. †††	$\boxed{3}$ 2.3 ± .2 inches Hg *** on test gage. Both engines running at 2500 rpm.		$\boxed{4}$ 5.3 to 5.8 psi on test gage. Both engines running at 2500 rpm with autopilot on.
Basic with Deice (Figure 204)		$\boxed{1}$ 8.0 ± .5 psi * on pneumatic pressure gage. Both engines running at 2500 rpm with deice system off. † On airplane serials P-308 and after, adjust ejector regulator for 6-7 psi with 8.0 ± .5 psi on pneumatic pressure gage (Figure 206).	$\boxed{3}$ 5.25 ± .25 inches Hg * on gyro pressure indicator. Both engines running at 2500 rpm. †††	$\boxed{4}$ 2.3 ± .2 inches Hg *** on test gage. Both engines running at 2500 rpm.		
		$\boxed{2}$ Adjust for peak pressure of 16 to 18 psi on pneumatic pressure gage. Both engines running at 2500 rpm with deice system on. †				
Basic With Deice, H-14 Autopilot and Pitch Trim (Figure 205)		$\boxed{1}$ 11.3 to 11.8 psi on pneumatic pressure gage. †† Both engines running at 2500 rpm with autopilot on and deice system off. †	$\boxed{3}$ 5.25 ± .25 inches Hg * on gyro pressure indicator. Both engines running at 2500 rpm. †††	$\boxed{4}$ 2.3 ± .2 inches Hg *** on test gage. Both engines running at 2500 rpm.	$\boxed{5}$ 11.0 to 11.5 psi on test gage. Both engines running at 2500 rpm with autopilot and deice system on.	$\boxed{6}$ 5.3 to 5.8 psi on test gage. Both engines running at 2500 rpm with autopilot on and deice system off.
		$\boxed{2}$ Adjust for peak pressure of 16 to 18 psi on pneumatic pressure gage. Both engines running at 2500 rpm with autopilot and deice system on. †				

Numbers designated $\square$ outline sequence that regulators should be adjusted and refer to indexes on corresponding illustrations. Gyro Instrument Pressure Regulator and Turn and Slip Pressure Regulator shown on Basic Pressure System illustration (Figure 201 only).

*If airplane has more than two air-driven gyros, increase Supply Pressure Regulator setting minimum amount required to obtain 5.25 ± .25 inches Hg on gyro pressure indicator (maximum Supply Pressure Regulator setting to be 12.3 psi at test gage).

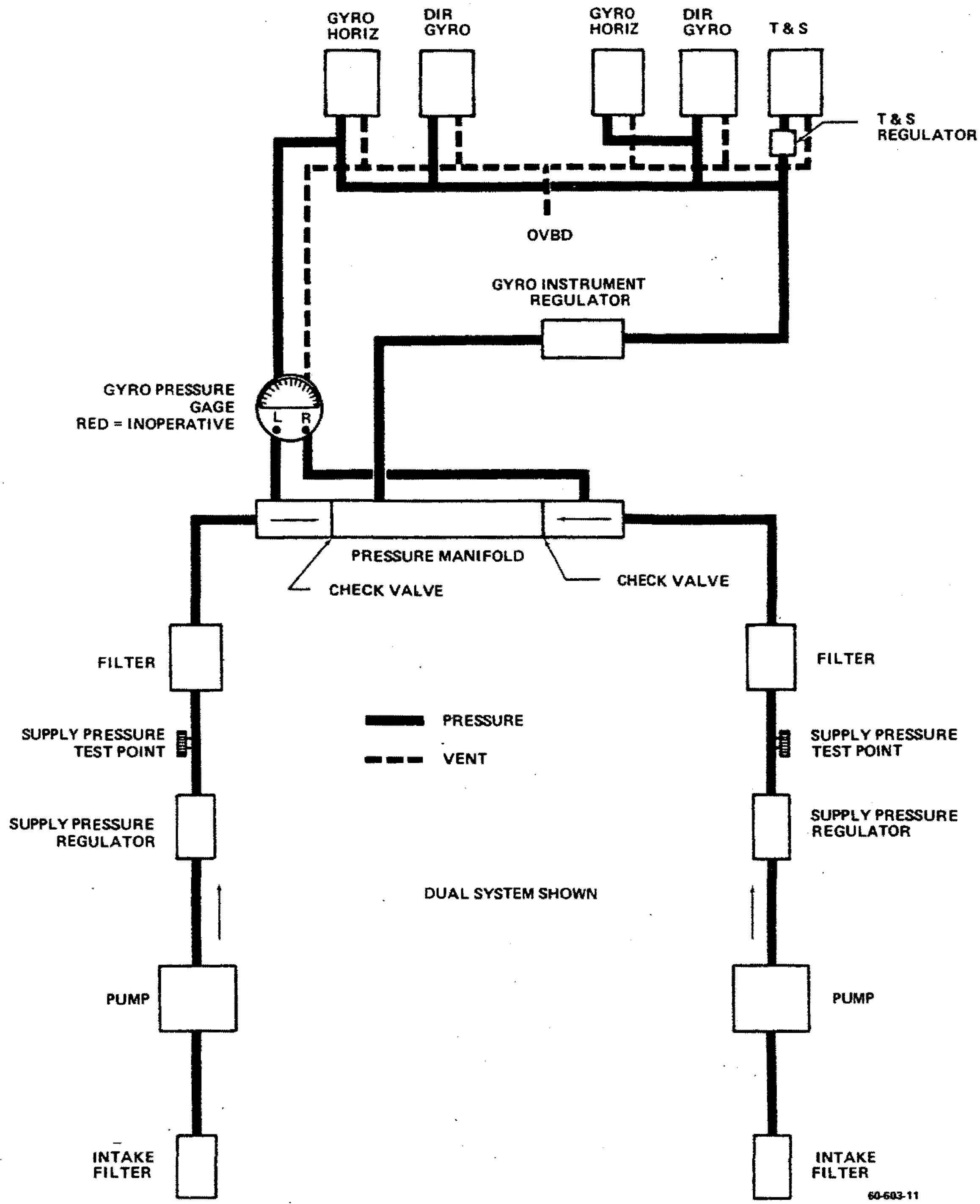
**Pressure will increase slightly with both engines running.

***Check in flight and if necessary, adjust to obtain standard rate turn.

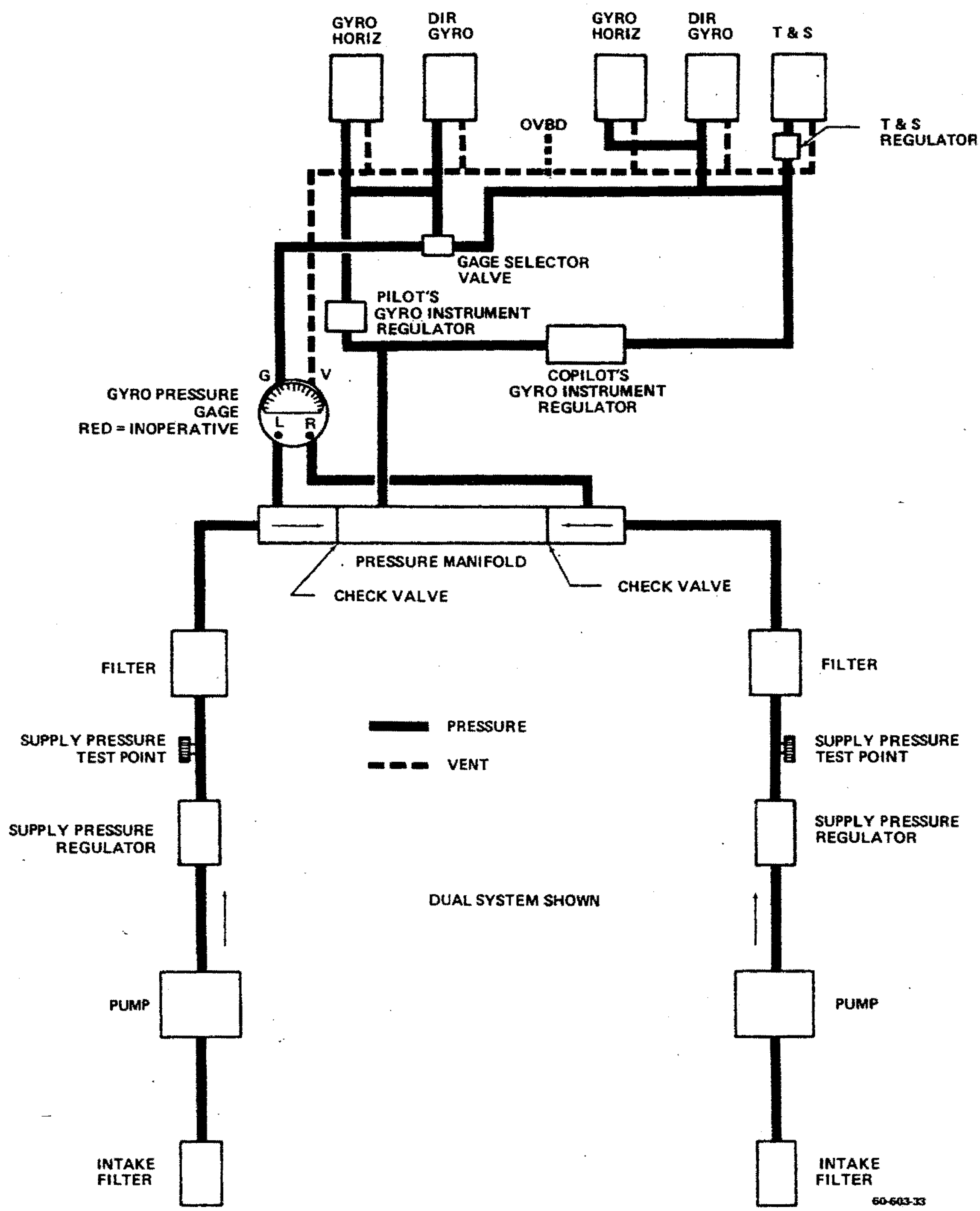
†Single-engine settings to be equalized at slightly lower pressure.

††13.5 to 14.5 psi on airplnaes prior to serials P-158 which do not have Kit No. 60-5015 S installed.

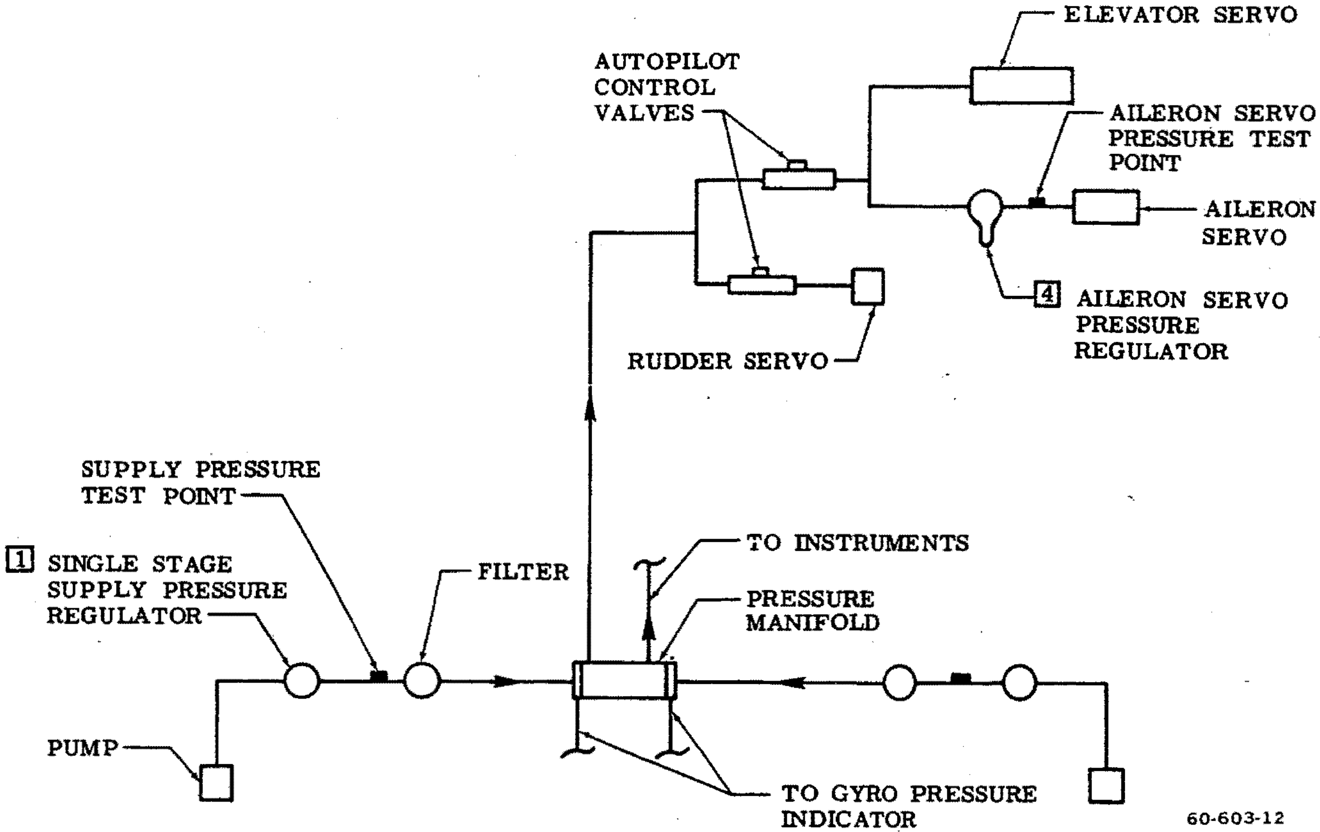
†††On airplane serials P-183 and after, select PILOT or COPILOT position of the gage selector to permit monitoring the gyro instrument pressure while adjusting the respective regulator.



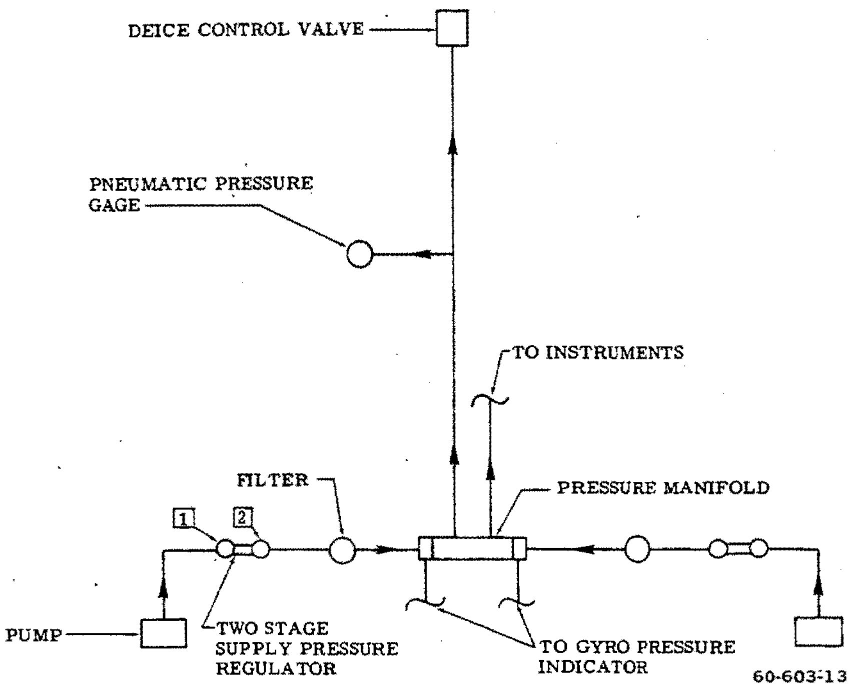
Pneumatic Pressure System (P-3 thru P-182)
Figure 201



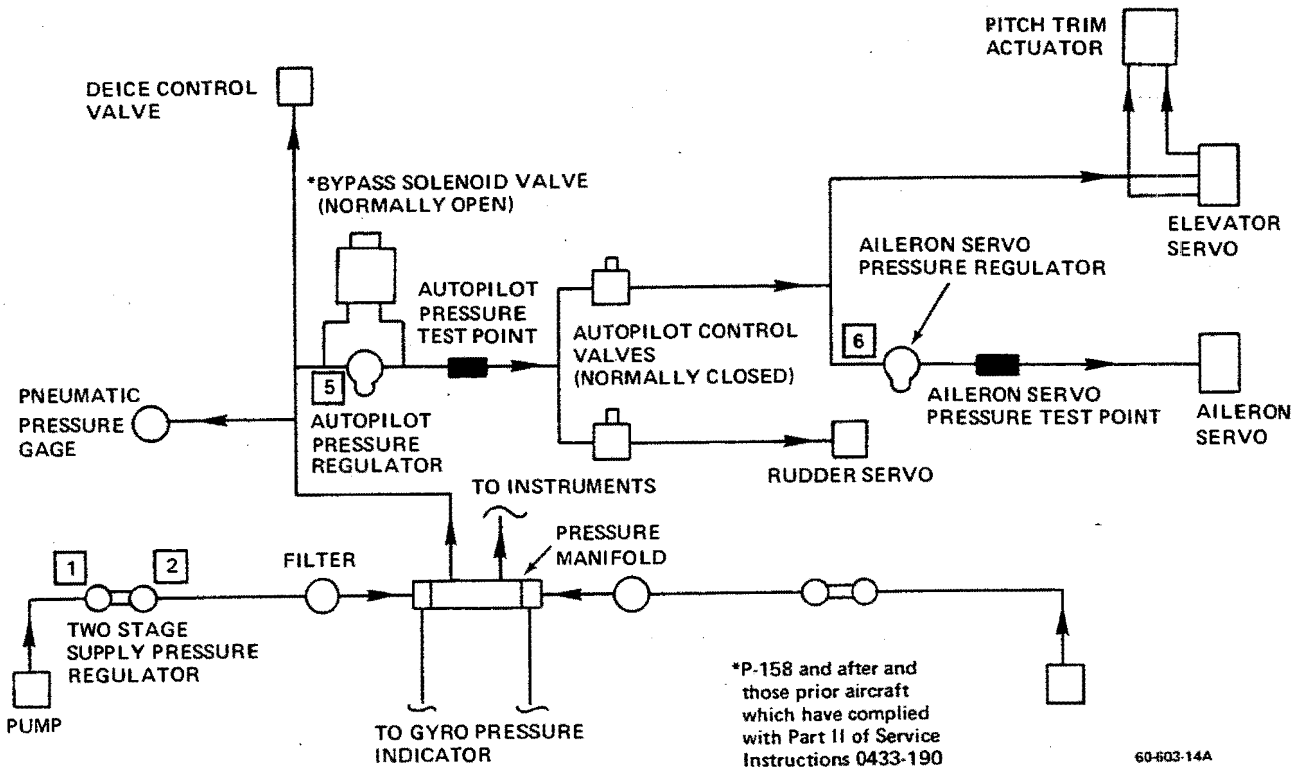
Pneumatic Pressure System (P-183 and after)
Figure 202



Pneumatic Pressure System (Basic with H-14 Autopilot)
Figure 203



Pneumatic Pressure System (Basic with Deice) (P-3 thru P-307)
Figure 204



Pneumatic Pressure System (Basic with H-14 Autopilot
Deice and Pitch Trim)
Figure 205

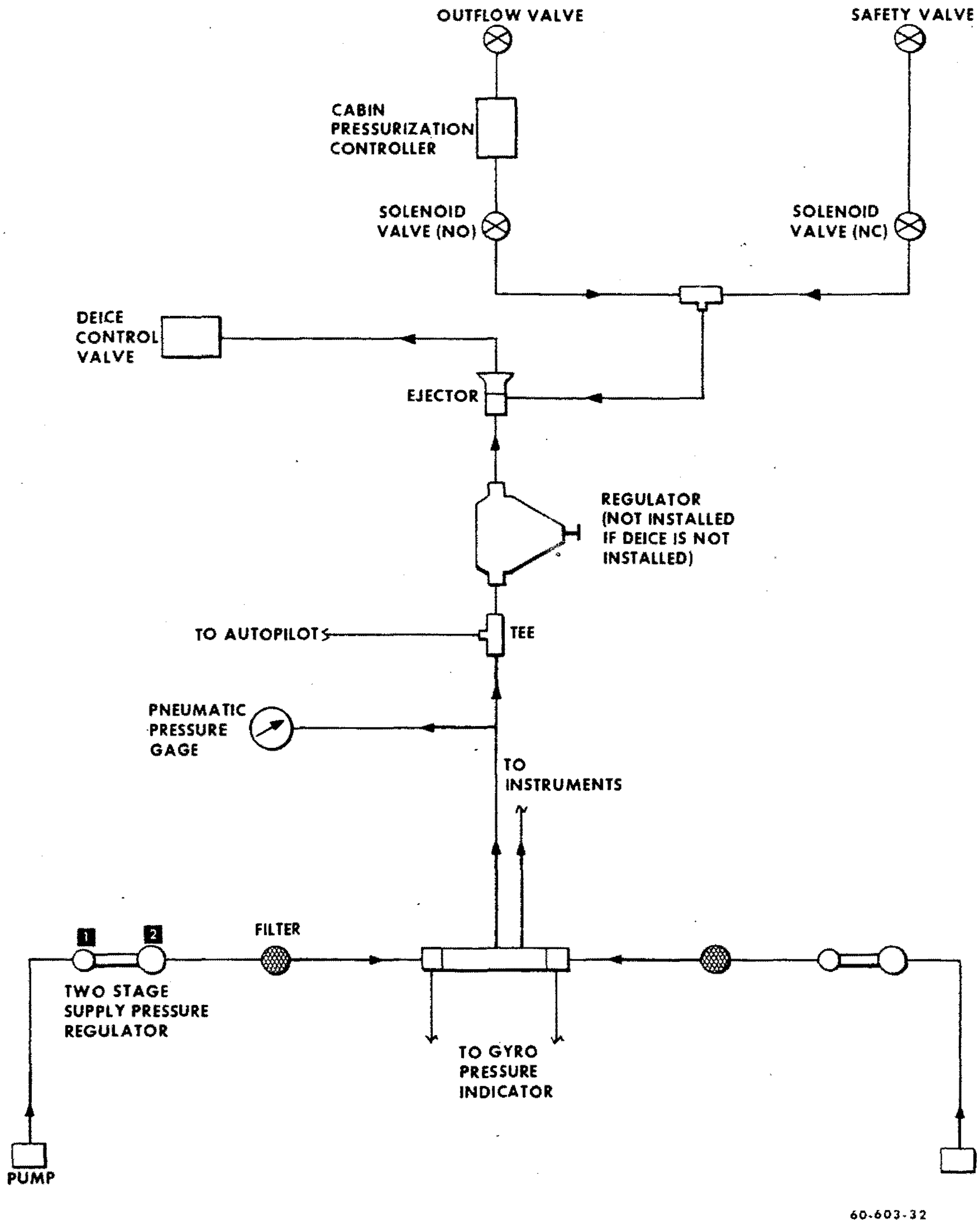
AILERON SERVO PRESSURE REGULATOR

The aileron servo pressure regulator is used when the H-14 autopilot is installed. The regulator is located inside the tail section just aft of the pressure bulkhead (see Figure 208). Adjust the regulator as follows:

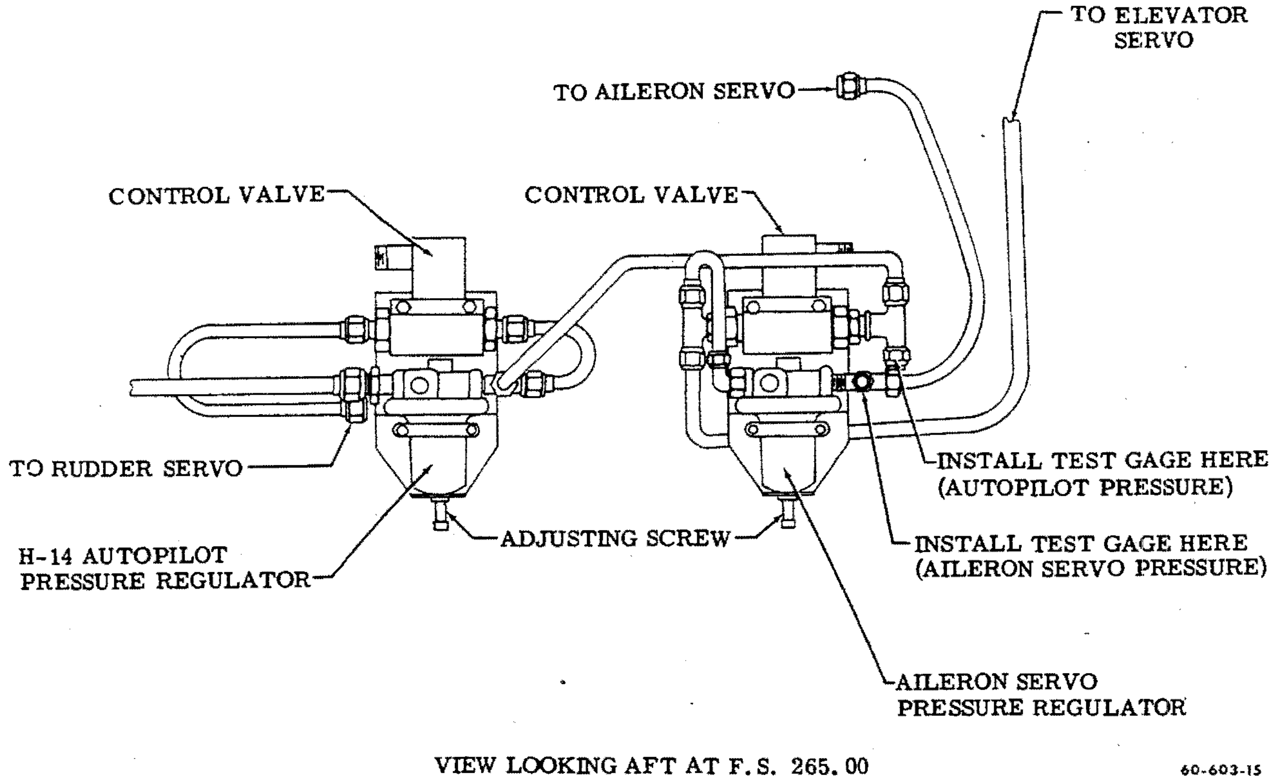
a. Remove the cap from the servo pressure test point and install a test gage (0-10 psi).

b. Loosen the check nut and adjust the regulator to the pressure indicated on the PNEUMATIC PRESSURE SYSTEM ADJUSTMENT CHART. Both engines should be running at 2500 rpm while the adjustment is being made. Rotate the adjusting screw clockwise to increase pressure and counterclockwise to decrease pressure.

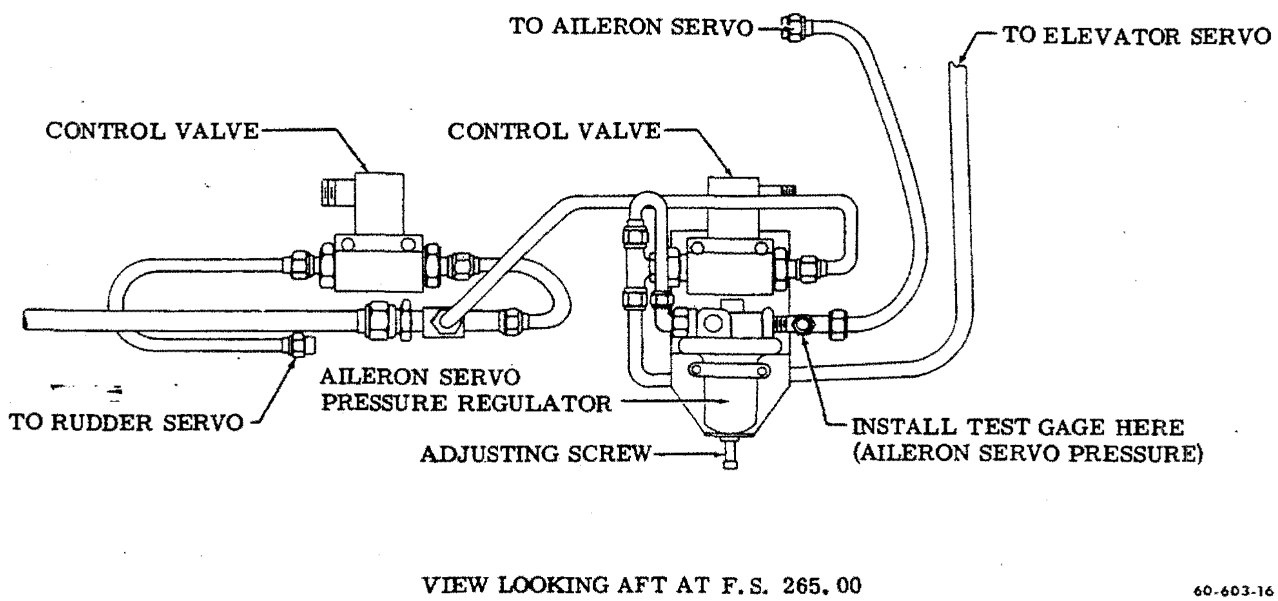
c. Tighten the check nut, remove the test gage and reinstall the cap on the test point.



Pneumatic Pressure System (Basic with Deice)
(P-308 and after)
Figure 206



Pressure Regulators (H-14 Autopilot and Aileron Servo)
Figure 207



Pressure Regulator (Aileron Servo)
Figure 208

"END"

CHAPTER 38

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CHAPTER 38 - WATER/WASTE

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WASTE DISPOSAL - DESCRIPTION AND OPERATION

The chemical toilet is located in the aft section of the airplane and is concealed by a bench-type seat in place of the optional fifth and sixth seat. The toilet is on the RH side of the seat and is accessible by lifting the RH seat cushion. The toilet is of the standard dry chemical type.

"END"

WASTE DISPOSAL - MAINTENANCE PRACTICES

CHEMICAL TOILET CLEANING

The toilet is of the standard dry chemical type. The toilet should be removed and emptied after each period of use. Any approved dry chemical may be used in accordance with the manufacturers instructions. A stiff (non-metallic) bristle brush and a water and detergent solution may be used to clean the toilet.

NOTE

For sanitary reasons, wear rubber gloves, elbow length, any time the toilet is to be cleaned or emptied.

a. Remove the RH seat cushion to gain access to the toilet.
b. Pull the toilet seat away from the seat deck. The toilet seat is attached with velcro fasteners.
c. Pull out the disposable waste bag and discard.
d. Place a new disposable waste bag in the bowl, making sure the bag overlaps the top of the bowl.
e. Place the toilet seat in position on the seat deck and press down in the area of the velcro fasteners.
f. Put the RH seat cushion back in position.

"END"

CHAPTER 51

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CHAPTER 51 - STRUCTURES

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GENERAL - DESCRIPTION AND OPERATION

Being of semimonocoque construction, the BEECHCRAFT Duke fuselage is pressurized to the skin between pressure bulkheads at stations 100.00 and 242.00 All skin, bulkheads and structure points, plumbing and wiring connections passing through a pressure wall, access doors, windows, control cables, and torque shafts are sealed to minimize air leakage. Although the carry through structure is an integral part of the fuselage, the wing panels may be removed at the attach points inboard of the nacelles. An emergency exit is installed on the right side of the fuselage at the forward cabin window. Individual passenger seats are provided, with the front seats installed facing aft.

"END"

GENERAL - MAINTENANCE PRACTICES

STRUCTURAL REPAIR

WARNING

Drilling, modification, or any type of work which creates a break in the pressure vessel is considered the responsibility of the owner or facility performing the work. Obtaining approval of the work is therefore, their responsibility.

In general, structural repair methods used on the BEECHRAFT Duke may be in accordance with AC 43. 13-2 AIRCRAFT INSPECTION AND REPAIR MANUAL. Never make a skin replacement or patch from a material thinner than the original skin. Patches should be of the next thicker material. The following considerations are recommended in addition to AC 43. 13-2 AIRCRAFT INSPECTION AND REPAIR MANUAL for repair of the pressure vessel of the Duke:

CAUTION

In the pressurized area, all skins, formers, stringers, etc., are structural members and should be treated as such.

a. All lap joints, including patches, must have at least two staggered rows of rivets.

b. All repair material must be free of any defects such as nicks, scratches, etc., which can cause stress rises.

c. Never dimple a structural member by driving the rivet head into the part.

d. Do not countersink deeper than 75% of the material thickness.

e. Scratches in the outer windows of acrylic plastic may be removed with 400 to 600 grit sandpaper, providing that not more than 0.30 inch of material is removed. Polish the repaired area smooth with buffing compound. The minimum thickness of the pilot's compartment side windows is 9/32 inch and for the cabin and baggage compartment windows, 7/32 inch. No crazing or cracks are permitted in the pressure windows.

REPAIR OF FIBERGLASS COMPONENTS

a. Large holes and cracks require that the damaged area be cut out and trimmed just beyond the area of damage. If the parts are painted, remove the paint and sand that portion of the part extending at least 2 inches beyond the cutout.

b. Prepare 3 patches of laminated glass cloth, such as Trevano, Uniglass, or their equivalent. Cut the first patch to the dimensions of the sanded area, the second patch 1/2-inch smaller than the first, and the third patch 1/2-inch smaller than the second.

c. Prepare the MIL-R-7575 resin (33, Chart 207, 91-00-00), for the patch in accordance with the manufacturer's instructions. Make sure that your hands are free of oil, grease, and dirt when handling the resin.

d. Apply an even coat of resin to the sanded area. Impregnate all three laminated glass cloth patches by laying the patches on clean waxed paper and working the resin through the fabric with a 2-inch brush.

e. Place the large patch over the cutout area, working out all air bubbles and wrinkles. If the patch starts to sag, place a support behind the repair area. Coat the support with automobile wax or waxed paper to prevent the resin from adhering to the support. Work out all air bubbles and wrinkles while installing the second patch over the first. Install the third patch over the second in the same manner.

f. Brush the repaired area with an even coat of resin. After the patches have cured for 24 hours at temperatures between 23°C (75°F) and 66°C (150°F), blend the patch into the contour of the part with fine sandpaper. Paint the repair to match the rest of the part.

"END"

CHAPTER 52

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"END"

CHAPTER 52 - DOORS

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"END"

GENERAL - DESCRIPTION AND OPERATION

The Duke is equipped with a fail safe cabin door latching mechanism. When the door latch bolts are in position, a spring-loaded secondary locking device maintains a safety locked condition. In addition, a pressure slide lock prevents inadvertent movement of either the secondary system or the door handle itself when pressurized. When the door is closed, the outside cabin door handle is spring loaded to fit into a recess in the door to create a flat, aerodynamically clean surface. The door may be locked with a key.

To open the door from the outside, press inward on the forward end of the handle to raise the aft end enough to grasp it. On serials P-123, P-127 and after, push the safety release button and lift the handle from its recess and turn it counterclockwise until the door opens. The door will swing out and forward over the left wing section. The door may be closed from the outside by rotating the handle clockwise. The three door latching bolts activate three switches mounted on the bulkhead behind the fuselage door frame. A fourth switch mounted on the door (serials P-4 through P-126, except P-123) is activated by the door handle latch mechanism. A cabin door warning light on the annunciator panel illuminates when the cabin door is not secure. All door switches must be activated to turn off the annunciator light.

To close the door from the inside, pull the door shut firmly with the handle in the forward position. Rotate the door handle aft in a counterclockwise manner until the safety lock bolt handle moves aft or the safety lock button pops outward. When the door handle has been rotated completely aft, (serials P-4 through P-126, except P-123) the safety lock bolt handle will snap forward to its original position.

At this point, the door is securely locked and cannot be opened except by moving the safety lock bolt full aft; or o the serials P-123, P-127 and after, pressing the safety loc button in. If there is residual pressure remaining in th cabin, the red "T" handle, located forward of the cabi door handle, must be pulled to override the pressur locking mechanism before the safety lock bolt or safet lock button will move. Once the safety lock bolt has bee pulled aft, or the safety lock button pressed in, the doo handle may be rotated forward to open the door.

CAUTION

> If the cabin door handle is rotated in an attempt to open the door and the safety lock bolt (P-4 through P-126, except P-123) is not in the full aft position, damage may result to the safety lock bolt mechanism.

The Duke 60 Series aircraft are equipped with a retractabl assist step, attached to the fuselage under the cabin door, t aid in entering and leaving the aircraft. A cable, attached t the actuator arm on the right hand main landing gear strut extends the assist step when the landing gear is extended When the landing gear is retracted, the assist step i retracted and fits flush with the fuselage.

The CABIN DOOR light in the annunciator remain illuminated until the door is closed, latched and locked, since all three latch pin switches are wired in parallel with one another; and on serials P-4 through P-126, excep P-123, with the door locked switch. When the cabin door i closed and latched, each latch pin compresses the actuato on its respective switch mounted on the bulkhead behind the aft frame of the doorway. When the cabin door handle is rotated to the locked position (serials P-4 through P-126, except P-123) a spacer at the bottom of the latch mechanism lock bolt compresses the arm on the door locked switch.

"END"

ENTRANCE STAIRS - MAINTENANCE PRACTICES

RETRACTABLE ASSIST STEP REMOVAL (Figure 201)

a. Remove the bolt (1) from the outboard side of the step (2).

b. Slide the step off far enough to clear the stops (6). Allow the step to rotate until the tension on the spring (5) is relieved.

c. Remove the step.

RETRACTABLE ASSIST STEP INSTALLATION

a. Place the spring in the step. Align the spring end in the corresponding hole in the step retainer (3).

b. Slide the step on the strut assembly shaft (4) and rotate counterclockwise until the remaining spring end is in place in the hole in the strut assembly shaft.

c. Continue rotating the step until the stops are aligned. Slide the step on until the stops engage.

d. Replace the bolt in the outboard side of the step.

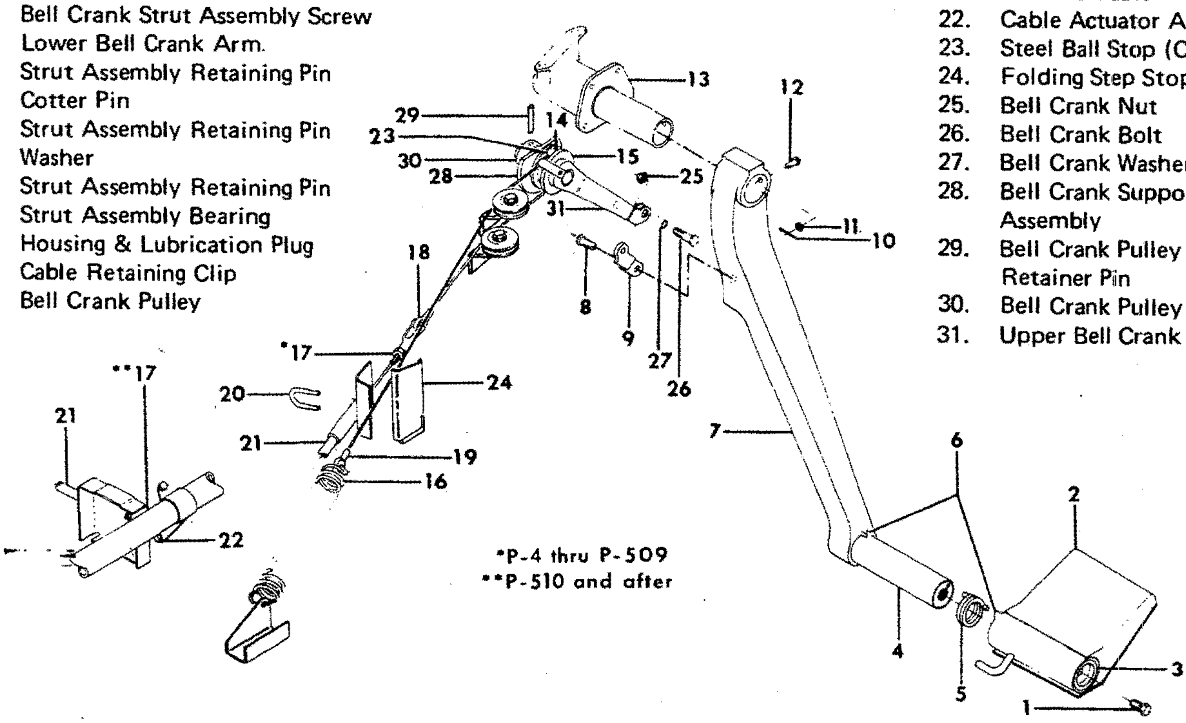
STEP ADJUSTMENT (FOLDED POSITION)

If the step is not flush with the skin when in the folded position it may be adjusted. This is done by loosening the two bolts in the stop (24), and sliding it up or down as needed.

STRUT ASSEMBLY REMOVAL (Figure 201)

a. Remove the small access plate below the cabin door in the area of the strut assembly (7).

1. Step Retaining Bolt
2. Cabin Step
3. Step Retainer
4. Step Assembly Shaft
5. Step Extension Spring
6. Step Extension Stops
7. Strut Assembly
8. Bell Crank Strut Assembly Screw
9. Lower Bell Crank Arm.
10. Strut Assembly Retaining Pin Cotter Pin
11. Strut Assembly Retaining Pin Washer
12. Strut Assembly Retaining Pin
13. Strut Assembly Bearing Housing & Lubrication Plug
14. Cable Retaining Clip
15. Bell Crank Pulley
16. Strut Assembly Extension Spring
17. Clevis Adjusting Rod End
18. Cable Clevis
19. Bell Crank Actuator Cable
20. U-bolt Cable Clamps
21. Covered Cable
22. Cable Actuator Arm
23. Steel Ball Stop (Cable)
24. Folding Step Stop
25. Bell Crank Nut
26. Bell Crank Bolt
27. Bell Crank Washer
28. Bell Crank Support Assembly
29. Bell Crank Pulley Shaft Retainer Pin
30. Bell Crank Pulley Shaft
31. Upper Bell Crank Arm



Retractable Assist Step
Figure 201

b. Remove the access plate from the bottom of the airplane in the area of the strut assembly.

c. Remove the assembly screw (8) which connects the lower bell crank arm (9) to the strut assembly.

d. Remove the cotter pin (10), washer (11) and pin (12) which secures the strut assembly to the bearing housing (13).

e. Remove the six strut assembly attaching bolts revealed by removing the bottom panel, and remove the bearing housing.

STRUT ASSEMBLY INSTALLATION

a. Position the bearing housing (13) through the bottom panel and install the six strut assembly attaching bolts. Install the bottom panel.

b. Position the strut assembly (7) to the bearing housing and secure with the pin (12), washer (11), and cotter pin (10).

c. Position the bell crank arm (9) to the strut assembly and secure with the attaching screw (8).

d. Install the access plate to the bottom of the airplane in the area of the strut assembly.

e. Install the small access plate below the cabin door in the area of the strut assembly.

CABLE REMOVAL (P-4 THRU P-509) (Figure 201)

a. Remove the large access plate below the cabin door.

b. Remove the L-shaped cable retaining clip (14) from the bell crank pulley (15).

c. Lower the flaps.

d. Release tension from the extension spring (16) by backing off the clevis adjusting rod end (17) from the clevis.

e. Separate the bell crank actuator cable at the cable clevis (18).

f. Disconnect the bell crank actuator cable (19) from the extension spring.

NOTE

The cable/return spring connection is accessible through holes which are exposed when the flaps are in the down position.

g. Remove the bell crank actuator cable.

h. Remove the long access plate inboard and slightly aft of the RH main landing gear door.

i. Remove the U-bolt clamps (20) from each end of the covered cable (21).

j. Detach the covered cable from the actuator arm (22) on the landing gear strut.

k. Note the routing of the covered cable and remove.

CABLE INSTALLATION (P-4 THRU P-509)

a. When installing either of the cables, peel laminations may be removed as required to allow the cable actuator arm (22) to rotate with 3 ± 2 inch-pounds torque.

NOTE

When installing the cables, be certain the steel ball stop (23) on the cable is in place on the bell crank pulley and tighten the rod end into the clevis to a depth of one inch. This is all that is necessary to rig the step travel.

b. Position the covered cable and route as noted during removal.

c. Attach the covered cable to the actuator arm (22) on the landing gear strut.

d. Install the U-bolt clamps (20) to each end of the covered cable.

e. Install the long access plate inboard and slightly aft of the RH main landing gear door.

f. Position the bell crank actuator cable and connect to the extension spring (16) and the clevis adjusting rod end (17).

g. Raise the flaps.

h. Install the L-shaped cable retaining clip (14) to the bell crank pulley (15).

i. Install the large access plate below the cabin door.

CABLE REMOVAL (P-510 AND AFTER) (Figure 201)

a. Remove the large access plate below the cabin door.

b. Remove the L-shaped cable retaining clip (14) from the bell crank pulley (15).

c. Remove the long access plate inboard and slightly aft of the RH main landing gear door.

d. Release the tension from the extension spring (16) by backing off the clevis adjusting rod end (17) from the cable actuator arm (22), located on the landing gear strut.

e. Lower the flaps.

f. Separate the bell crank actuator cable at the cable clevis (18).

g. Disconnect the bell crank actuator cable (19) from the extension spring.

NOTE

The cable/return spring connection is accessible through holes which are exposed when the flaps are in the down position.

h. Remove the bell crank actuator cable.

i. Remove the U-bolt clamps (20) from each end of the covered cable (21).

j. Detach the covered cable from the actuator arm (22) on the landing gear strut.

k. Note the routing of the covered cable and remove.

CABLE INSTALLATION (P-510 AND AFTER)

a. When installing either of the cables, peel laminations may be removed as required to allow the cable actuator arm (22) to rotate with 3 ± 2 inch-pounds torque.

NOTE

When installing the cables, be certain the steel ball stop (23) on the cable is in place on the bell crank pulley and tighten the rod end into the clevis to a depth of one inch. This is all that is necessary to rig the step travel.

b. Position the covered cable and route as noted during removal.

c. Position the bell crank actuator cable (19) and connect to the extension spring (16) and the non-adjustable clevis end of the covered cable.

d. Attach the clevis adjusting rod end (17) of the covered cable to the actuator arm (22) on the landing gear strut.

e. Install the U-bolt clamps (20) to each end of the covered cable.

f. Install the long access plate inboard and slightly aft of the RH main landing gear door.

g. Raise the flaps.

h. Install the L-shaped cable retaining clip (14) to the bell crank pulley (15).

i. Install the large access plate below the cabin door.

BELL CRANK ASSEMBLY REMOVAL (Figure 201)

a. Remove the screw that attaches the bell crank to the strut assembly.

b. Remove the bell crank nut (25), bolt (26) and washer (27) from the upper bell crank arm (31). Remove the lower bellcrank arm (9).

c. Remove the access plate on the under side of the airplane, near the bell crank.

d. Remove the access plate below the cabin door in the area of the bell crank.

e. Remove the bell crank actuator cable as described in CABLE REMOVAL.

f. Locate the bell crank support assembly (28) in the lower access opening and remove the bell crank pulley shaft retainer pin (29) from the bell crank pulley shaft (30).

g. Remove the upper bell crank arm (31), the bell crank pulley (15) and bell crank pulley shaft (30).

BELL CRANK ASSEMBLY INSTALLATION

a. Position the upper bell crank arm (31), pulley (15) and shaft (30) to the bell crank support assembly (28) and install the retainer pin (29) to the bell crank shaft (30).

b. Install the bell crank actuator cable as described in CABLE INSTALLATION.

c. Install the access plate below the cabin door in the area of the bell crank.

d. Install the access plate on the underneath side of the airplane, near the bell crank.

e. Install the lower bell crank arm (9) to the upper bell crank arm (31) and secure with the attaching bolt (26), washer (27) and nut (25).

f. Install the screw that attaches the bell crank to the strut assembly.

"END"

DOOR WARNING - MAINTENANCE PRACTICES

The door locked and door latched switches will not normally require adjustment except when a new switch is installed.

a. Adjust the latch pin switches as follows:

NOTE

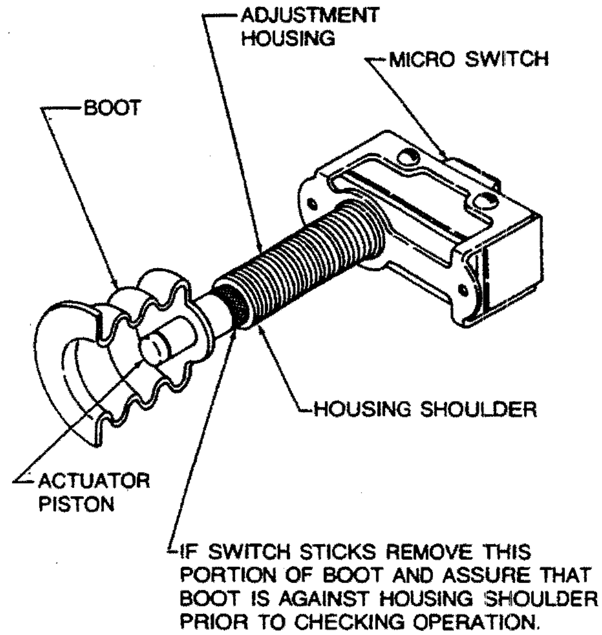
Before making adjustments to the latch pin switches be sure the latch pins are properly adjusted as outlined under DOOR LATCH ADJUSTMENT in this chapter.

1. Remove the cabin upholstery panels adjacent to the upper, lower and center latches to gain access to the switches.
2. Close and lock the cabin door.
3. Rotate the cabin door handle clockwise against the lock mechanism stop while in the locked position. This will eliminate the effect of play in the lock mechanism.
4. Back the switch adjustment off until the switch is not actuated.
5. Readjust the switch until it actuates.
6. Adjust upper and lower switch overtravel to .12 to .20 inch and middle switch overtravel to .07 to .11 inch.

NOTE

One complete revolution of the adjusting nut will provide .031 inch travel.

7. Reopen the cabin door and note if the switch remains in the actuated position due to the friction of the rubber boot on the actuating piston. If this occurs remove the safety wire on the boot, trim one-half of that portion of the boot which rides the actuating piston as indicated in Figure 201 and slide the boot along the piston until it rests against the shoulder of the adjustment housing.
8. Install new safety wire on the boot and close, lock and open the door to check for proper operation.
9. Install the cabin upholstery panels.



Switch Boot Modification
Figure 201

b. Adjust the door locked switch (P-4 thru P-126, except P-123) as follows:

1. Remove the upholstery panel under the window of the cabin door to gain access to the door locked switch.
2. Loosen the attaching screws and position the switch in its mounting slots so that the CABIN DOOR light goes out when the door is closed, latched, and locked.

"END"

CHAPTER 53

LIST OF PAGE EFFECTIVITY

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53 - EFFECTIVITY/CONTENTS	1	Oct 27/75
53-30-00	201	Oct 27/75
	202	Oct 27/75

CHAPTER 53 - FUSELAGE

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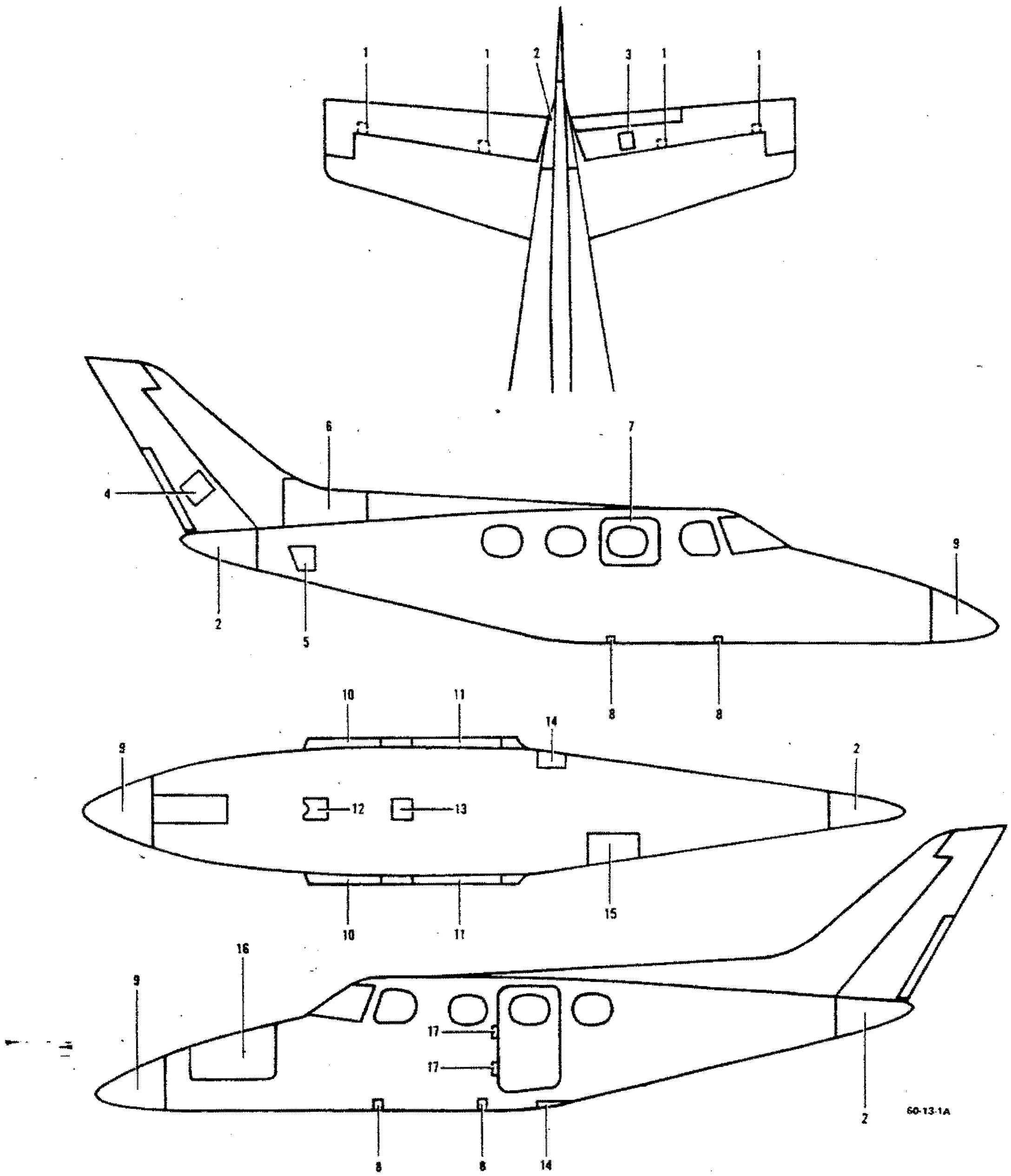
"END"

PLATES/SKIN - MAINTENANCE PRACTICES

FUSELAGE ACCESS OPENINGS

The panels, plates and doors as shown in Figure 201, provides maintenance access to the components, plumbing and cables enclosed within the fuselage. When installed, they continue the aerodynamic lines of the fuselage with little increase of drag.



Fuselage Access Openings
Figure 201 (Sheet 1 of 2)

1. Elevator Hinges
2. Tail Cone
3. Elevator Trim Tab Actuator
4. Rudder Trim Tab Actuator
5. Deicer Dump Valve, Elevator Bell Crank, Rudder Bell Crank and Control Cables
6. Vertical Stabilizer Deicer Hose
7. Emergency Exit
8. Wing Bolts
9. Nose Cone
10. Intercooler
11. Uplock Cable, Retract Rods, Retract Rod Pressure Seals and Wing Stub Fuel Fittings
12. Lower Pedestal
13. Landing Gear, Gearbox and Actuator
14. Assist Step Mechanism
15. Autopilot Aileron, Rudder and Elevator Servos, Magnetic Navigation Sensing Element (B-5P Autopilot) and Autopilot Computer (H-14 Autopilot)
16. Oxygen Filler and Bottle, Heater, Ram Air Plenum, Brake Fluid Reservoir, Avionics Equipment and Baggage Compartment
17. Cabin Door Hinges

Fuselage Access Openings
Figure 201 (Sheet 2 of 2)

"END"

CHAPTER 55

LIST OF PAGE EFFECTIVITY

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55-EFFECTIVITY	1	Feb 27/81
55-CONTENTS	1	Feb 27/81
55-00-00	1	Nov 2/73
55-10-00	201	Nov 2/73
55-20-00	201	Feb 27/81
	202	Feb 27/81
	203	Feb 27/81
55-30-00	201	Nov 2/73
55-40-00	201	Feb 27/81
	202	Feb 27/81
	203	Feb 27/81

"END"

CHAPTER 55 - STABILIZERS

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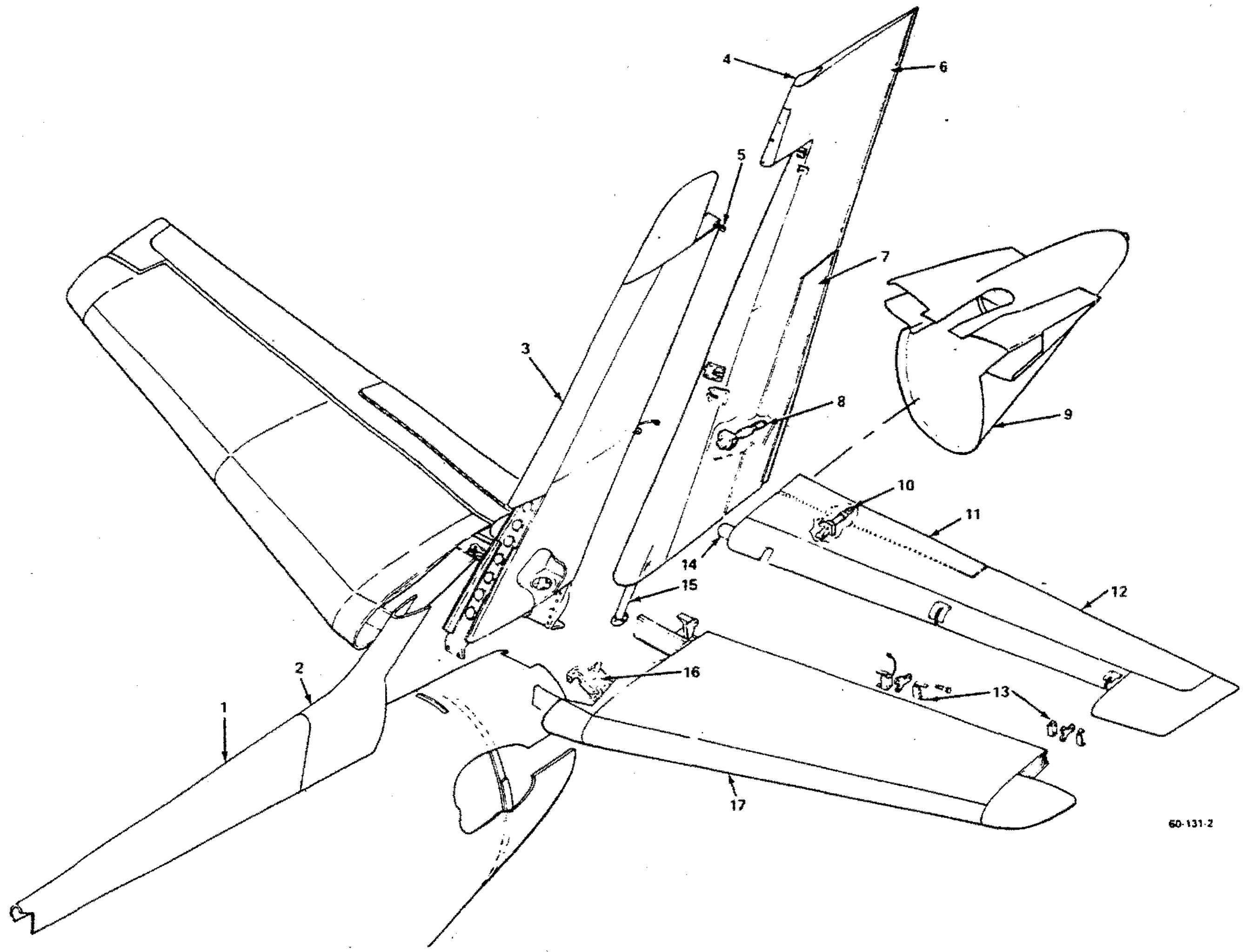
"END"

GENERAL - DESCRIPTION AND OPERATION



1. Dorsal Fairing
2. Dorsal Saddle Fairing
3. Vertical Stabilizer
4. Beacon
5. Rudder Hinge Bracket
6. Rudder
7. Rudder Trim Tab
8. Rudder Trim Tab Actuator
9. Tail Cone
10. Elevator Trim Tab Actuator
11. Elevator Trim Tab
12. Elevator
13. Elevator Hinge Brackets
14. Elevator Torque Tubes
15. Rudder Torque Tube
16. Rudder Bell Crank
17. Horizontal Stabilizer

Empennage
Figure 1

"END"

HORIZONTAL STABILIZER - MAINTENANCE PRACTICES

HORIZONTAL STABILIZER REMOVAL

a. Remove the tail cone and elevators. (Refer to Chapter 27-30-00.)
b. Remove the dorsal saddle fairing and lower vertical stabilizer fairings.
c. Remove the access cover on the lower aft right side of the fuselage.
d. Disconnect the surface deicer tubes at the horizontal stabilizers.
e. Remove the bolts attaching the horizontal stabilizers to the fuselage bulkheads.
f. Carefully pull the horizontal stabilizers outboard and clear of the fuselage.

HORIZONTAL STABILIZER INSTALLATION

a. Carefully move the horizontal stabilizers inboard into position at the fuselage bulkheads and install the attaching bolts. Torque all 5/16-24 bolts to 100 to 140 inch-pounds and 3/8-24 bolts to 160 to 190 inch-pounds.

NOTE

The attaching bolts shall have no threads bearing against structural members. Proper torque must be maintained without bolt rotation in the bolt holes.

b. Connect the surface deicer tubes at the horizontal stabilizers.
c. Install the access cover on the lower aft right side of the fuselage.
d. Install lower vertical stabilizer fairings and the dorsal fairing.
e. Install the elevators and tail cone. (Refer to Chapter 27-30-00.)

"END"

ELEVATOR - MAINTENANCE PRACTICES

ELEVATOR BALANCING
(Figure 201)

After repainting and/or repair, the finished elevator must be check balanced to ensure that its static moment about the hinge line is within the prescribed limits. The static moment for all completed elevator assemblies must fall within the range of 12.9 to 25.1 inch-pounds underbalance (tail heavy) at the measured moment about the hinge line. The static moment of the elevator is determined by multiplying the unbalanced weight of the elevator assembly times the perpendicular distance from the hinge center line to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced elevator assembly is 0.0 inch-pounds. Tail heaviness indicates static underbalance while nose heaviness indicates static overbalance.

NOTE

> Control surfaces ordinarily need not be rebalanced unless they are repainted, repaired or have parts replaced. When repainting, hang the control surfaces by the trailing edge so excess paint will drain toward the leading edge.

The balance weight of the right elevator assembly is manufactured of lead or steel shot and epoxy resin. This weight is constructed in such a manner that adding weight is not recommended, but material may be removed to reduce weight. This weight should be sufficiently heavy to allow repainting and still check balance within the range of 12.9 to 25.1 inch-pounds underbalance (tail heavy). Even though the right elevator balance weight cannot be added to, the elevator MUST have the balance checked any time the elevator is repainted, repaired, or any work is done which might affect the balance.

CHECKING BALANCE

The balance must be checked in a draft free area with the elevator completely assembled in flying condition. All painting, including stripes and touch-up, must be completed. The tab, tab push rod, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, the simplest is counterbalancing: The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the elevator assembly.

EQUIPMENT REQUIRED TO PERFORM CHECK BALANCING

a. A stand with knife edge supports as illustrated in Figure 201. The knife edges must be in the same horizontal plane.
b. A cup or similar light weight container.
c. Approximately 3 pounds of lead shot.
d. A certified beam balance weighing device calibrated in units of 0.01 pound or less.
e. A straight edge, ruler, and spirit level.

BALANCING PROCEDURE

COUNTERBALANCING METHOD

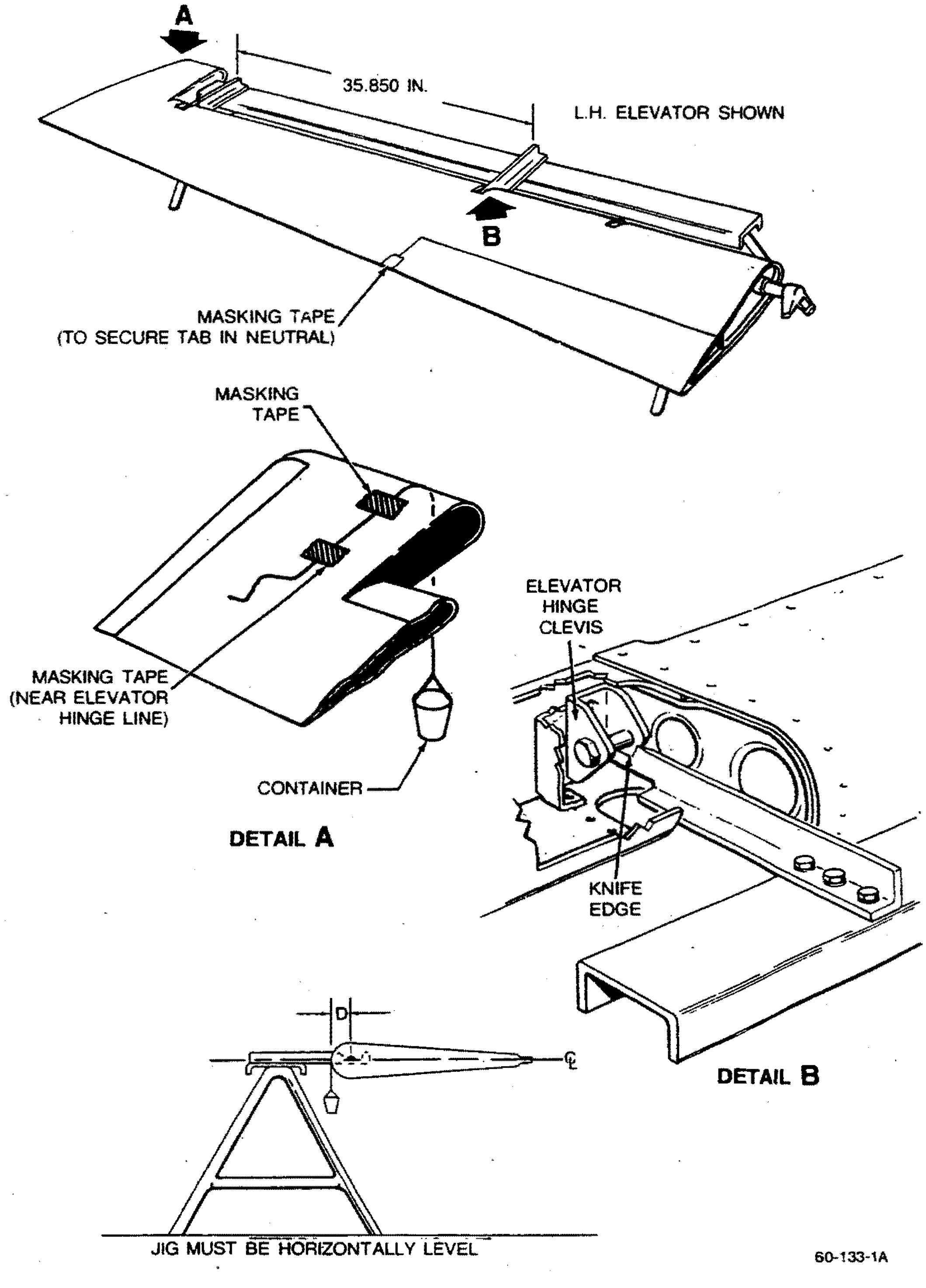
a. Locate the chord line by placing a stright edge at the inboard end of the elevator assembly so that one end is on the hinge center line (at the center of the torque tube) and the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straight edge.
b. Secure the trim tab in its neutral position with a small piece of masking tape.
c. Fit the correct size bolts in the hinge clevises and mount the elevator on the knife edge supports. Ensure that the elevator is free to rotate about the hinge line.
d. To determine if weight should be added or removed, suspend a cup from a point near the inboard end of the balance weight assembly on the elevator leading edge. Use a short length of small diameter string secured to the surface with a small piece of masking tape as illustrated in Figure 201. The cup must be free to hang vertically.
e. Add small quantities of lead shot to the cup until the elevator balances with the chord line level. Check this by holding the spirit level aligned with the marked chord line.
f. Carefully measure the perpendicular distance "D" within 0.1 inch from the hinge line to the point of suspension of the cup.
g. Remove the cup, contents, and string, then weight them.

NOTE

> Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

h. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by "W".



Balancing the Elevator
Figure 201

2. The underbalance moment is designated by "M".

3. M = W x D

4. The following is a typical example of a balancing calculation: Suspend a cup from the leading edge and add the required amount of lead shot. If the elevator balances with the chord line level at "W = 2.00 pound" and "D = 10.0 inches", then . . .

M = 2.00 x 10.0

M = 20.00 inch-pounds (The product of "W x D" must be accurate to within 0.10 inch-pounds.) In this instance, "M" is within the required static balance range and is therefore acceptable.

i. If the static balance does not fall within the range of 12.9 to 25.1 inch-pounds tail heavy (underbalance), weight must be added or removed (left elevator only) and the balance rechecked.

Remove the balance weight (left elevator only) and add or remove solder to bring the elevator balance within required limits. Coat the weight with a corrosion preventative material such as zinc chromate primer to insulate the dissimilar metals. Replace the balance weight and recheck the balance.

"END"

VERTICAL STABILIZER - MAINTENANCE PRACTICES

VERTICAL STABILIZER REMOVAL

a. Remove the tail cone and rudder. (Refer to Chapter 27-20-00.)

b. Remove the dorsal saddle fairing and the lower vertical stabilizer fairings.

c. Disconnect the antenna coaxial cable.

d. Disconnect the surface deicer tubes at the vertical stabilizer.

e. Remove the bolts attaching the vertical stabilizer to the fuselage bulkheads.

f. Carefully raise the vertical stabilizer clear of the fuselage.

VERTICAL STABILIZER INSTALLATION

a. Carefully lower the vertical stabilizer into position at the fuselage bulkheads and install the attaching bolts. Torque all 5/16-24 bolts to 100 to 140 inch-pounds and 3/8-24 bolts to 160 to 190 inch-pounds.

NOTE

The attaching bolts shall have no threads bearing against structural members. Proper torque must be maintained without bolt rotation in the bolt holes.

b. Connect the surface deicer tubes at the vertical stabilizer.

c. Connect the antenna coaxial cable.

d. Install the lower vertical stabilizer fairings and the dorsal saddle fairing.

e. Install the rudder and tail cone. (Refer to Chapter 27-20-00.)

"END"

RUDDER - MAINTENANCE PRACTICES

RUDDER BALANCING
(Figure 201)

After repainting and/or repair, the finished rudder must be check balanced to ensure that its static moment about the hinge line is within the prescribed limits. The static moment for all completed rudder assemblies must fall within the range of 21.1 to 31.2 inch-pounds underbalance (tail heavy) at the measured moment about the hinge line. The static moment of the rudder is determined by multiplying the unbalanced weight of the rudder assembly times the perpendicular distance from the hinge center line to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced rudder assembly is 0.0 inch-pounds. Tail heaviness indicates static underbalance while nose heaviness indicates static overbalance.

CHECKING BALANCE

The balance must be checked in a draft free area with the rudder completely assembled in flying condition. All painting, including stripes and touch-up, must be completed. The tab, tab push rod, static wicks, anti-collision light, chain and cable assembly, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, the simplest is counterbalancing: The application of a known force of weight at a measured distance from the hinge line to counter the unbalance moment of the rudder assembly.

EQUIPMENT REQUIRED TO PERFORM CHECK BALANCING

a. A stand with knife edge supports as illustrated in Figure 201. The knife edges must be in the same horizontal plane.
b. A can or similar light weight container.
c. Approximately 9 pounds of lead shot.
d. A certified beam balance weighing device calibrated in units of .01 pound or less.
e. A straight edge, ruler, and spirit level.

BALANCING PROCEDURE

COUNTERBALANCING METHOD

a. Locate the chord line by placing a straight edge at the lower closure rib of the rudder so that one end is aligned with the center of the torque tube while the other end is centered on the trailing edge. Mark the chord line with a suitable marker, such as a grease pencil, then remove the straight edge.
b. Secure the trim tab in its neutral position with a small piece of masking tape.
c. Fit the correct size bolts in the hinge brackets and mount the rudder on the knife edge supports. Ensure that the rudder is free to rotate about the hinge line.
d. Suspend a can from a point on the leading edge directly above the lower hinge skin cutout. Use a short length of small diameter string secured to the surface with a small piece of masking tape as illustrated in Figure 201. The can must be free to hang vertically.
e. Add small quantities of lead shot to the can until the rudder balances with the chord line level. Check this by holding a spirit level aligned with the marked chord line.
f. Carefully measure the perpendicular distance "D" within 0.1 inch from the hinge line to the point of suspension of the can.
g. Remove the can, contents, and string, then weigh them.

NOTE

Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

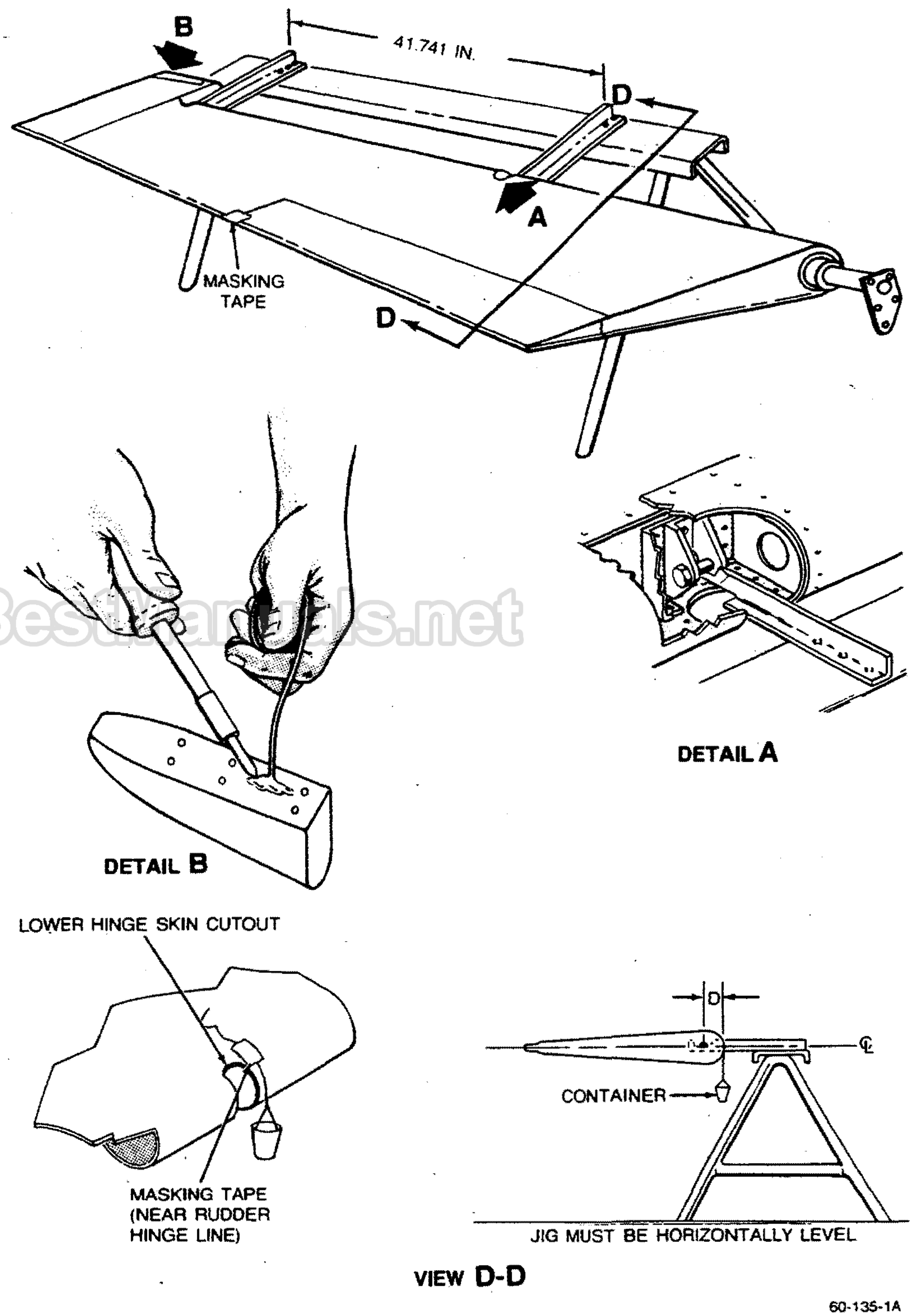
h. Calculate the static balance as follows:

1. The weight of the can and contents is designated by "W".
2. The underbalance moment is designated by "M".
3. M = W x D
4. The following is a typical example of a balancing calculation: If the rudder balances with the chord line level at "W = 8.00 pound" and "D = 3.5 inches", then . . .

M = 8.00 x 3.5

M = 28.00 inch-pounds (The product of "W x D" must be accurate to within 0.10 inch-pounds.) In this instance, "M" is within the required static balance range and is therefore acceptable.

i. If the static balance does not fall within the range of 21.1 to 31.2 inch-pounds underbalance, remove the rudder horn weight and add or remove solder to bring the rudder balance within the required limits.
j. The weight of the solder to be added or removed is calculated as follows:



Balancing the Rudder
Figure 201

1. The weight of solder to be added or removed is designated "W_1".

2. The moment difference between the actual measurement and the required moment is designated "M_1".

3. The perpendicular distance from hinge center line to the point of solder removal or addition is designated "D_1".

4. $W_1 = M_1 \div D_1$

5. The following are typical examples of required solder changes:

a. If the rudder balances at "M_1 = 32.0 inch-pounds" then "M_1 = 32.0 - 31.2 or 0.8 inch-pounds" and "D_1 = 8.5 inches" then W_1 = 0.8 ÷ 8.5 or 0.09 pounds of solder to be added.

b. If the rudder balances at "M_1 = 20.0 inch-pounds", then "M_1 = 20.0 - 21.1 or -1.1 inch-pounds" and "D_1 = 8.5 inches", then W_1 = -1.1 ÷ 8.5 or -0.13 pounds of solder to be removed.

"END"

CHAPTER 56

LIST OF PAGE EFFECTIVITY

CHAPTER SECTION SUBJECT	PAGE	DATE
56-EFFECTIVITY/CONTENTS	1	May 30/7
56-00-00	201	Nov 2/73
56-10-00	201	Nov 2/73
	202	May 30/7
56-20-00	201	May 30/7

CHAPTER 56 - WINDOWS

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"END"

GENERAL - MAINTENANCE PRACTICES

CLEANING PLASTIC WINDOWS

A commercial cleaning compound made specifically for acrylic plastic windows may be used. When using a commercial cleaner follow the instructions on the container.

If a commercial cleaner is not available, these instructions should be followed:

Cleaning of the acrylic plastic windows should never be attempted when dry. The window should first be flushed with water or a mild soap solution, then rubbed slightly with a grit-free soft cloth, chamois or sponge. Stubborn grease or oil deposits are readily removed with aliphatic naphtha or hexane. Rinse with clear water.

CAUTION

Do not use thinner or aromatic abrasive cleaners to clean the windows as they will damage the surface of the plastic. Aliphatic naphtha and similar solvents are highly inflammable, and extreme care must be exercised when used.

"END"

FLIGHT COMPARTMENT - MAINTENANCE PRACTICES

WINDSHIELD REMOVAL
(Figure 201)

a. Remove the windshield heater wiring from the lower corners of the windshield (heated windshield only).
b. Remove the screws that hold the retainer strips on the front of the windshield.
c. Remove the retainer strips from around the windshield.
d. Remove the windshield.
e. Remove the old sealer from the retainer strips and window frame with toluol.

NOTE

Do not allow the toluol to come in contact with the plastic window as it will craze the surface.

WINDSHIELD INSTALLATION
(Figure 201)

a. It is suggested that Y9136 teflon tape (8, Chart 205, 91-00-00) should be applied to all areas of the windshield that will come in contact with the windshield frame or the windshield retainer strips. The tape will keep the sealer from bonding permanently to the windshield and will facilitate future windshield removal procedures.
b. Apply PR1221 sealer (9, Chart 205, 91-00-00) to the windshield frame.
c. Place the windshield in position and secure by starting an attaching screw in each corner. Fill the gap between the windshield and the windshield frame with PR1221 sealer (9, Chart 205, 91-00-00).
d. Place the retainer strips in position and secure in place with the attaching screws. Tighten the screws (in alternate rows progressively) to a torque of 16 to 20 inch-pounds.

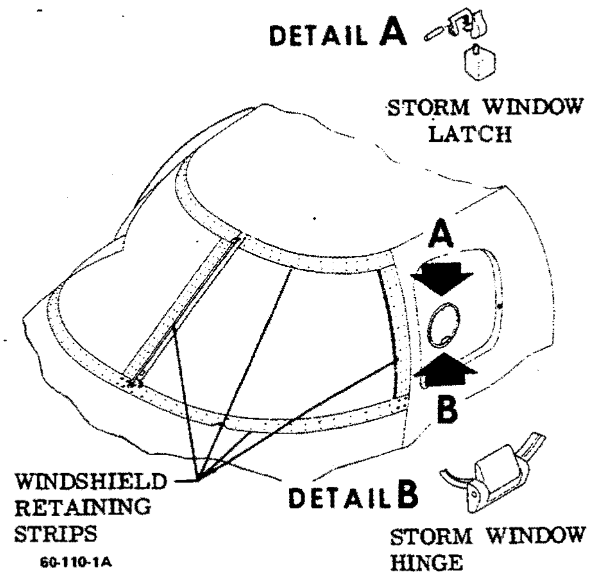
CAUTION

Overtightening the screws will cause damage to the windshield.

e. Connect the windshield heater wiring to the lower corners of the windshield as they were on the old windshield (heated windshield only).

STORM WINDOW LATCH REMOVAL
(Figure 201)

a. Using an Allen wrench in the end of the latch attaching bolts to prevent the bolts from turning, remove the nuts from the bolts.
b. Remove the latch.



Windshield Replacement
Figure 201

NOTE

Care should be taken not to damage the attaching bolts or the plexiglass block to which the hinge attaches. If either of these are damaged beyond use, the entire window assembly must be replaced.

STORM WINDOW LATCH INSTALLATION
(Figure 201)

a. Position the latch on the storm window.
b. Using an Allen wrench in the end of the latch attaching bolts to prevent the bolts from turning, install the nuts on the bolts and secure.

STORM WINDOW HINGE REMOVAL
(Figure 201)

a. Loosen the two set screws in the plexiglass hinge block and punch the hinge pin out from one end.
b. Remove the hinge block.

NOTE

The hinge pin and the set screws are the only replaceable parts in the hinge. If either hinge block is damaged, the window assembly to which it is attached must be replaced.

STORM WINDOW HINGE INSTALLATION (Figure 201)

a. Position the hinge block and install the hinge pin.
b. Secure the hinge pin with the set screws.

FLIGHT COMPARTMENT SIDE WINDOW REMOVAL (Figure 202)

a. Remove the screws from the inner window frame and remove the window frame.
b. Remove the L-shaped retaining clips from around the window.
c. Remove the window. If the window is not bonded tightly to the airplane skin, remove the window intact. If the window is tightly bonded, the bulk of the window may be cut away, leaving a narrow strip of window bonded to the airplane skin. This strip may then be peeled or broken away.

CAUTION

Do not use a sharpened metal tool or knife to cut the sealant from around the window or damage to the area may result.

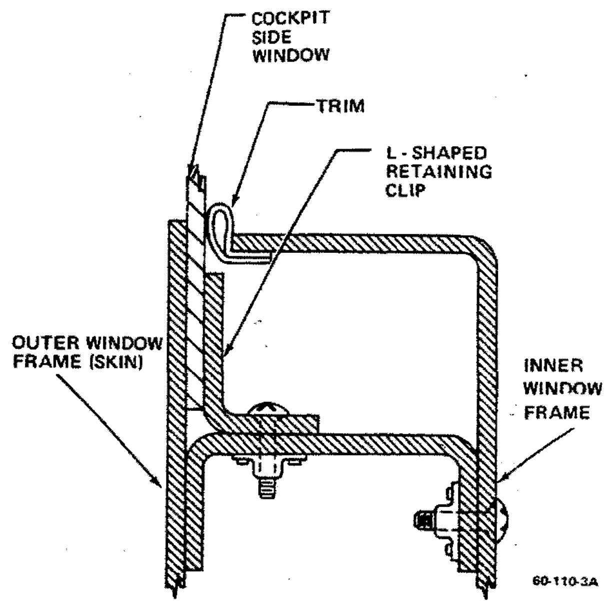
d. Clean the old sealant from the airplane skin by scraping with a sharpened wood or plastic tool. Sand lightly to remove all traces of the old sealant.

FLIGHT COMPARTMENT SIDE WINDOW INSTALLATION (Figure 202)

a. Clean all bonding surfaces with naphtha (20, Chart 207, 91-00-00). Clean both the airplane skin and the plastic window bonding surfaces.
b. Rough sand the bonding surface, of both the airplane skin and the window, using 60 grit emery cloth. Exercise caution not to sand the surface of the window which will be exposed.
c. Thoroughly clean each sanded surface, using a clean white rag dampened with naphtha (20, Chart 207, 91-00-00). Continue cleaning until no discoloration appears on the rag.

NOTE

Do not use red shop rags for cleaning, as they contain oil.



Flight Compartment Side Window
Figure 202

d. Immediately prior to applying the sealant, clean the metal part (bond area only), using EC3911 degreasing primer (45, Chart 207, 91-00-00). Remove all traces of powder by brushing or wiping with a clean, lint free cloth.

CAUTION

Do not apply EC3911 degreasing primer to fiberglass or plastic parts.

e. Prepare the sealant, EP711 (5, Chart 205, 91-00-00), per the manufacturers instructions.
f. Apply a uniform layer of the prepared sealant, 1/16 inch to 1/8 inch thick over the contact bond area of the airplane skin.
g. Carefully position the window in place. Apply sufficient pressure to force a small amount of sealant out at the periphery of the bond area. Maintain a light pressure while securing the window, using the L-shaped retaining clips and attaching screws.
h. Permit the sealant to cure.
i. After the sealant has cured, use a sharpened wood or plastic tool to remove the excess fillet of sealant on the exposed surface of the window.
j. Clean the window using naphtha (20, Chart 207, 91-00-00).
k. Install the inner window frame. Secure it, using the attaching screws.

"END"

CABIN - MAINTENANCE PRACTICES

CABIN SIDE WINDOW REMOVAL (Figure 201)

a. If the curtains are installed, remove the spring clips from each end of the window curtain tracks and slide the curtains to the center of the window.

b. Remove the attaching screws (exposed by moving the curtains) from the inner window frame and remove the inner window frame.

c. Remove the attaching screws from around the inner window. Remove the inner window and the inner window molding. See Figure 201, Cabin Side Window.

d. Remove the U-shaped retaining clips.

e. Remove the window. If the window is not bonded tightly to the airplane skin, remove the window intact. If the window is tightly bonded, the bulk of the window may be cut away, leaving a narrow strip of window bonded to the airplane skin. This strip may then be peeled or broken away.

CAUTION

Do not use a sharpened metal tool or knife to cut the sealant from around the window or damage to the area may result.

f. Clean the old sealant from the airplane skin by scraping with a sharpened wood or plastic tool. Sand lightly to remove all traces of the old sealant.

CABIN SIDE WINDOW INSTALLATION (Figure 201)

a. Clean all bonding surfaces with naphtha (20, Chart 207, 91-00-00). Clean both the airplane skin and the plastic window bonding surfaces.

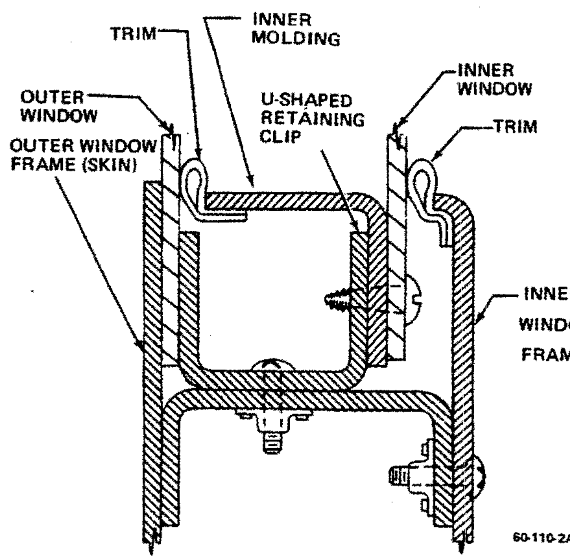
b. Rough sand the bonding surface, of both the airplane skin and the window, using 60 grit emery cloth. Exercise caution not to sand the surface of the window which will be exposed.

c. Thoroughly clean each sanded surface, using a clean, white rag dampened with naphtha (20, Chart 207, 91-00-00). Continue cleaning until no discoloration appears on the rag.

NOTE

Do not use red shop rags for cleaning, as they contain oil.

d. Immediately prior to applying the sealant, clean the metal part (bond area only), using EC3911 degreasing primer (45, Chart 207, 91-00-00). Remove all traces of powder by brushing or wiping with a clean, lint free cloth.



Cabin Side Window
Figure 201

CAUTION

Do not apply EC3911 degreasing primer to fiberglass or plastic parts.

e. Prepare the sealant, EP711 (5, Chart 205, 91-00-00), per the manufacturers instructions.

f. Apply a uniform layer of the prepared sealant, 1/16 inch to 1/8 inch thick over the contact bond area of the airplane skin.

g. Carefully position the window in place. Apply sufficient pressure to force a small amount of sealant out at the periphery of the bond area. Maintain a light pressure while securing the window, using the U-shaped retaining clips and attaching screws.

h. Permit the sealant to cure.

i. After the sealant has cured, use a sharpened wood or plastic tool to remove the fillet of excess sealant on the exposed surface of the window.

j. Clean the window using naphtha (20, Chart 207, 91-00-00).

k. Install the inner window molding and position the inner window, secure to the U-shaped outer window retaining clips with the attaching screws.

l. Install the inner window frame in position and secure with the attaching screws.

m. If curtains are installed, slide the curtains into position and install the spring clips.

"END"

CHAPTER 57

LIST OF PAGE EFFECTIVITY

"END"

CHAPTER 57 - WINGS

TABLE OF CONTENTS

"END"

GENERAL - DESCRIPTION AND OPERATION

The all-metal wing group consists of the fuselage carry-through structure, outboard wing panels, leading edge, wing tips, flaps, aileron and aileron trim tabs, and the integral fuel cells. The wing tips, flaps, ailerons, and fuel cells are readily removable. To remove the wing assembly, engine removal is required.

CARRY-THROUGH STRUCTURE

The carry-through structure, to which the wing assemblies are attached, is riveted to the fuselage and forms an integral part thereof. The upper forward carry-through extruded spar cap is of clad 2024-T3 aluminum alloy; while the lower spar cap is of 2014-T6 aluminum alloy. A web of clad 2024-T3 aluminum alloy sheet encloses the area between both spar caps. The aft (one piece) extruded spar cap is of clad 2416-T6 aluminum alloy.

OUTBOARD WING

Two spars, their attaching ribs and skin, constitute the box beam construction used throughout the wing. The outer wing spars are of the same construction as the carry-through structure, except that a combination of clad 2014-T4 aluminum alloy extrusions and formed clad 2024-T4 aluminum alloy U-channel members comprise the main spar caps while those of the rear spar are composed of formed clad 2024-T3 and 2024-T4 aluminum alloy angles and clad 2024-T3 cap strips. The stamped ribs and formed stringers used throughout the wing are of clad 2024-T3 aluminum alloy. Clad 2024-T3 aluminum skin covers the entire wing. The wing tips are formed of clad 6061-T4 aluminum alloy sheets and are attached to the wing with screws. Two fuel cells are located in the leading edge, and a nacelle and box section cell is located between the main and rear spar in each wing assembly. Each fuel cell cavity is lined with clad 2024-T3 aluminum alloy sheet.

"END"

GENERAL - MAINTENANCE PRACTICES

WING TIP REMOVAL

NOTE

On aircraft equipped with pneumatic surface deicers, the deicer boot must be removed from the wing tip before the wing tip can be removed. Refer to Chapter 30-10-00 for deicer boot removal and installation procedures.

a. Remove the two access plates, located on the lower side of the wing tip.

b. Loosen the clamps and disconnect the three vent lines from the fuel vent float valve.

c. Remove the screws attaching the wing tip to the wing.

d. Disconnect the electrical leads to the navigation and landing lights.

WING TIP INSTALLATION

a. Connect the electrical leads to the navigation and landing lights.

b. Position the wing tip to the wing and install the attaching screws.

c. Install the three vent lines on the fuel vent float valve. Torque the hose clamps to 25 ± 5 inch-pounds.

d. Reinstall the deicer boots (If applicable).

e. Reinstall the access plates on the lower side of the wing tip.

WING REMOVAL

a. Drain and purge all fuel cells.

b. Remove the wing mounting bolt access plates from the top and bottom of the wing.

c. Place the aircraft on a three point jack to prevent an unbalanced condition of the airplane after the wing is removed.

d. Place a wing stand under the wing that is not being removed and place a stand under the tail. Place two adjustable screw jacks under the wing being removed, one jack just inboard of the nacelle and one near the wing tip.

e. Remove the engine as instructed in Chapter 71-00-00.

f. Open the brake cylinder bleed ports and pump all fluid from the system.

g. Retract the landing gear until the inboard landing gear doors are fully open.

h. Disconnect the inboard door actuating rod from the control horn.

i. Disconnect the landing gear actuator rod from the V-brace in the wheel well.

j. Disconnect the aileron cables at the turnbuckles in the wheel well and remove the roll pins from the inboard aileron cable pulley brackets. Disconnect the aileron tab cables and aileron tab stops in the left wheel well.

k. Disconnect the hydraulic brake line at the inboard connection in the wheel well.

l. Disconnect the fuel lines between the wing root rib and the fuselage.

m. Remove the leading edge cover of the wing located between the fuselage and nacelle.

n. Disconnect the pressurization ducting in the leading edge of the wing stub, and disconnect the firewall shutoff control cable.

o. Disconnect the flap drive shaft at the flap actuator and remove the clamps attaching the shaft housing to the wing.

p. Remove the lower aft nacelle fairing assembly.

q. Remove the inboard nacelle fairing.

r. Remove the clamps securing the wire bundles to the wing inboard leading edge. Disconnect the wire bundles at the terminals located on the aft side of the firewall.

s. Disconnect the wiring to the electrical components located in each side of the upper nacelle.

t. Disconnect and cap all plumbing between the wing root rib and the fuselage.

WARNING

The two air conditioner lines between the right wing root rib and the fuselage are high pressure lines. Before disconnecting the two lines, loosen the fitting just enough to bleed off the pressure slowly.

u. Disconnect the flap wire bundle and safety switch wiring in the left wheel well. Disconnect the plumbing and electrical wiring (boost pump and fuel quantity transmitter) in the wheel well.

v. Remove the clamps securing the engine controls to the leading edge.

w. Position two support jacks under the wing.

NOTE

Outline the position of the wing on the fuselage, using a grease pencil. This will aid realignment when the wing is reinstalled.

CAUTION

If bolt binding occurs, adjust the position of the wing until the bolt disengages freely. Do not screw or drive a bolt into, or out of the fittings.

x. Remove the wing attach bolts from the fittings.
y. Remove the wing by pulling it straight away from the fuselage.

NOTE

The soft aluminum washers between the upper wing attach fittings and the preload indicating washer under the nut at the lower forward wing attach point must be discarded and new components installed when the wing is reinstalled.

WING INSTALLATION

a. Using a nonmetalic brush and naphtha or methyl ethyl ketone (20 or 21, Chart 207, 91-00-00), clean the wing attach fittings and hardware (bolts, washers, and nuts). Inspect the wing attach fittings and attaching hardware as instructed under WING BOLT, NUT, AND FITTING INSPECTION.

WARNING

Wing bolts and nuts that have reached their life limit (10 years after the initial inspection) must not be reused (see Chart 202).

b. Coat the fitting bolt bores and bearing faces, bolts, washers and nuts with MIL-C-16173 Grade II corrosion preventive compound (43, Chart 207, 91-00-00).
c. Place the slide in the fuselage fitting at the leading edge attach point as shown in Figure 205.
d. Guide the flap shaft and landing gear retract rod into their respective positions.
e. Align the wing and fuselage fittings, install the new soft aluminum washers between the upper wing attach fittings, and insert the bolts into the fittings.

CAUTION

Each bolt must be inserted by hand without binding. If a bolt cannot be easily inserted, reposition the wing until the bolt moves freely through the fittings. Do not screw or drive a bolt into, or out of the fittings. Bolts, nuts and washers must be oriented as shown in the applicable illustration for each location (Figure 201, 202, 203, 204 and 205).

f. Start the nuts on the bolts and rotate the wing trailing edge until the wing aligns with the outline drawn on the fuselage. After alignment is established, verify that the lower forward bolt is not binding on the bolt bore. If bolt binding is encountered, adjust the position of the wing until the bolt moves freely in the fittings.

CAUTION

When torquing the wing nuts, assure that the wrenches do not come into contact with the wing attach fittings. Such an occurrence could result in damage to the fittings and false torque readings.

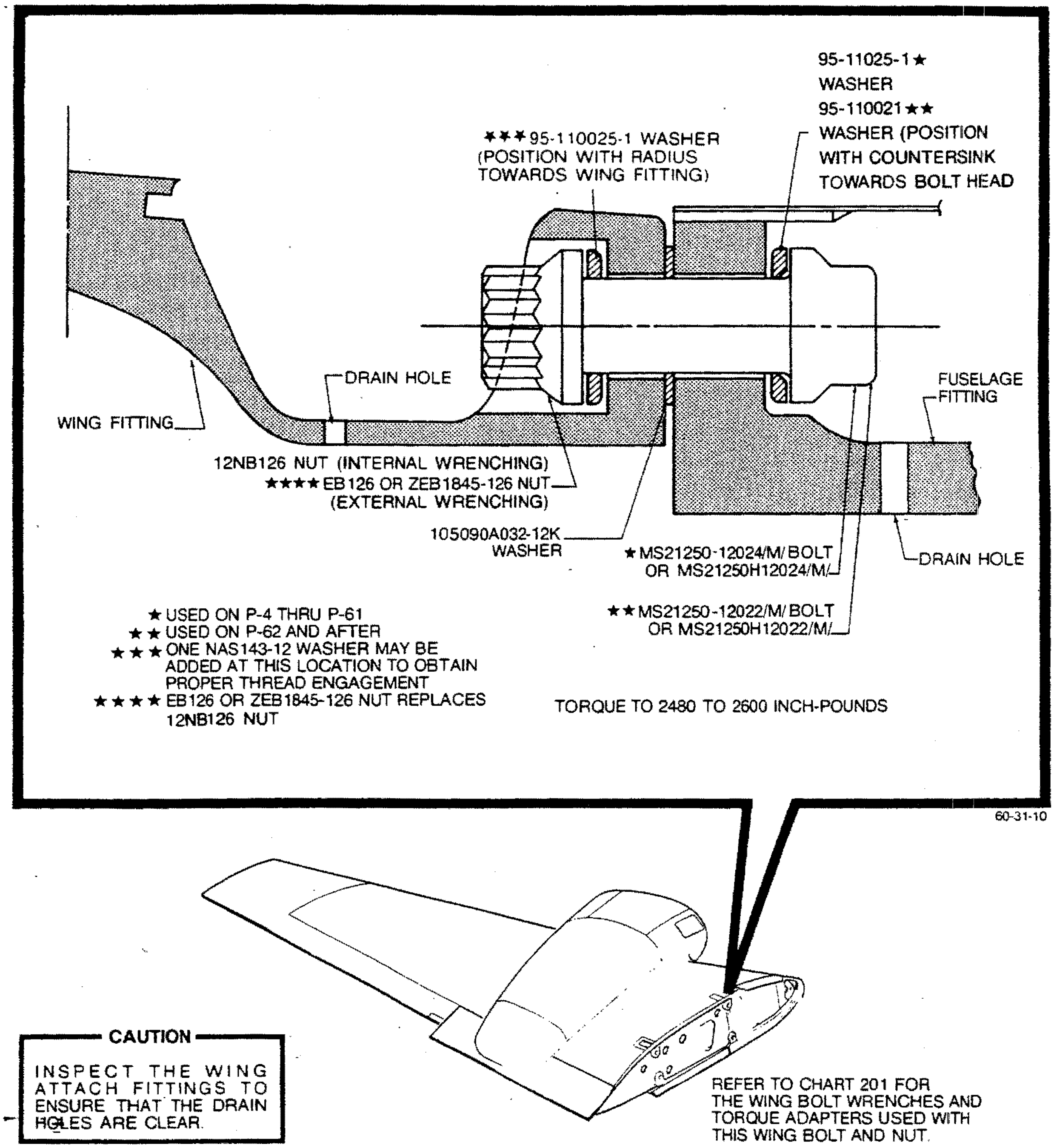
g. Tighten the upper forward nut and remove the holding force from the wing cradle (if used). Torque the remaining three nuts in the following order: upper aft, lower forward, and lower aft. When a torque wrench adapter is used, the length of the adapter must be added to the length of the torque wrench and the proper torque value computed as detailed in Chapter 20-00-00.

NOTE

Each nut must be torqued to the value shown in the appropriate illustration for each location (Figure 201, 202, or 204). However, the lower forward attach point is not torqued to a specific torque value and must be tightened as instructed in Figure 206.

CAUTION

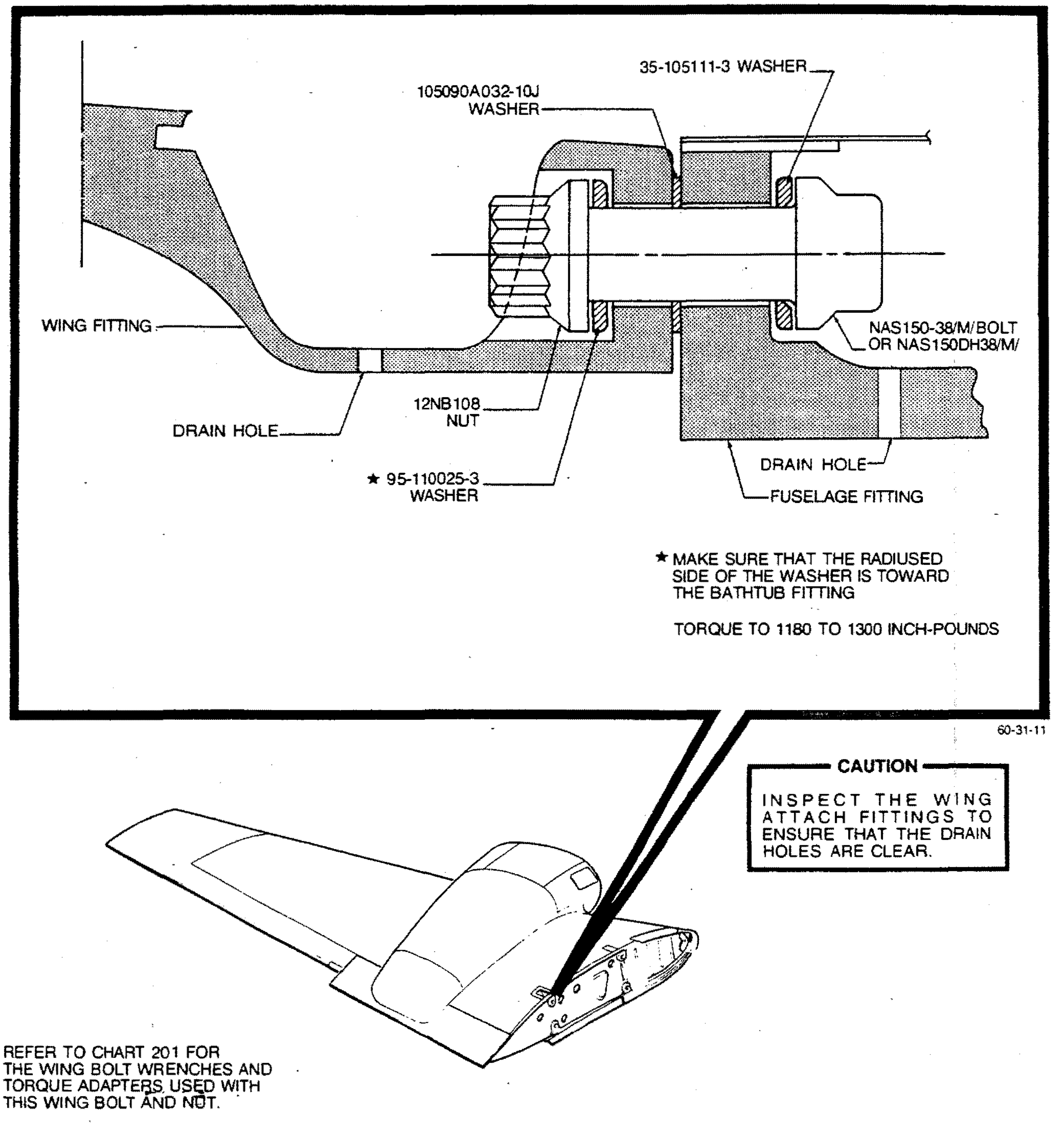
Before the lower aft nut is torqued, a slight gap may exist between the fittings. This gap must not exceed a width of .030 inch. No gap should remain after the nut is torqued. Torque the wing attach bolts at the nut end. Do not rotate the bolt in the bolt bore.



CAUTION

INSPECT THE WING ATTACH FITTINGS TO ENSURE THAT THE DRAIN HOLES ARE CLEAR.

Upper Forward Wing Bolt Installation
Figure 201

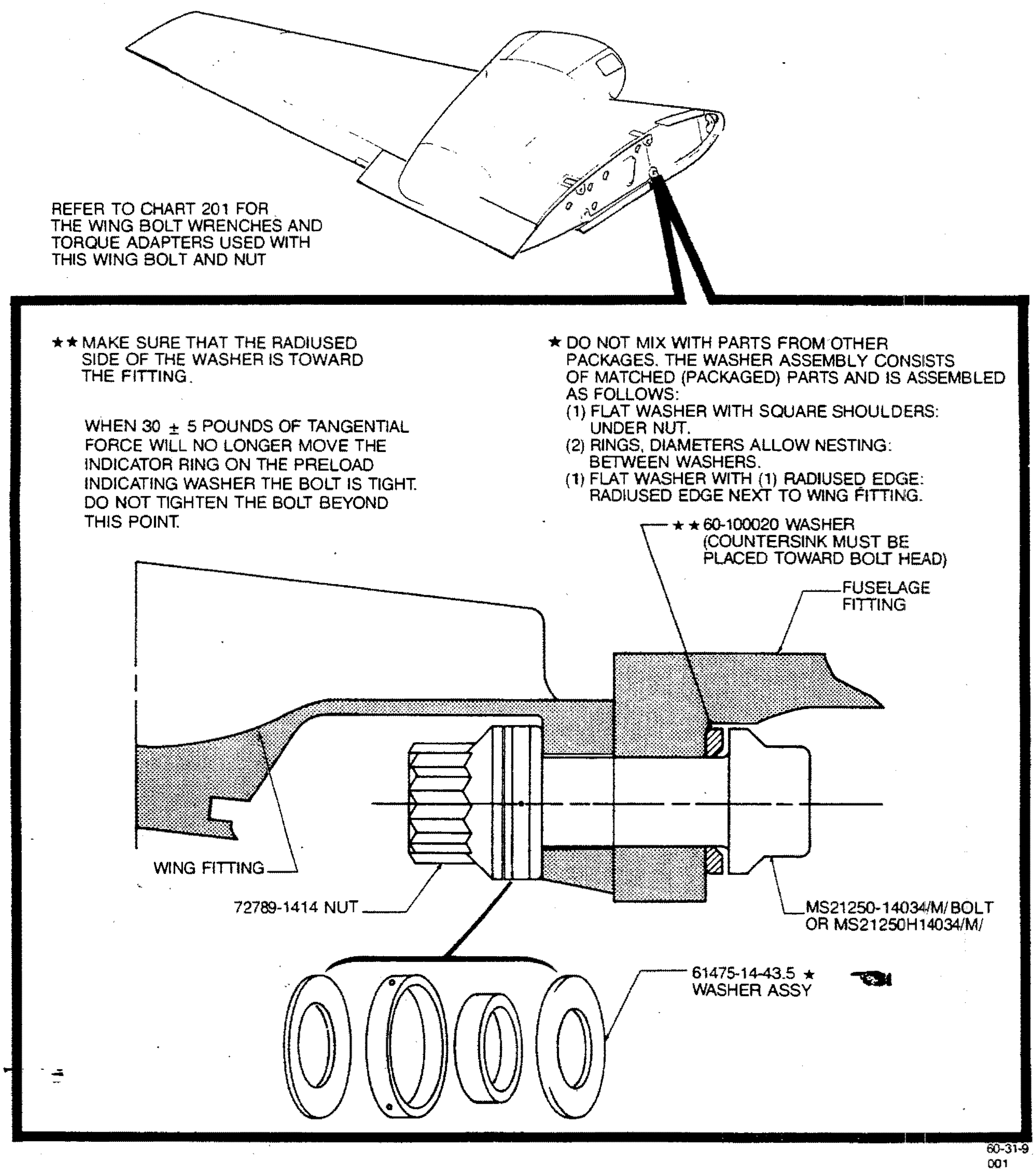


CAUTION

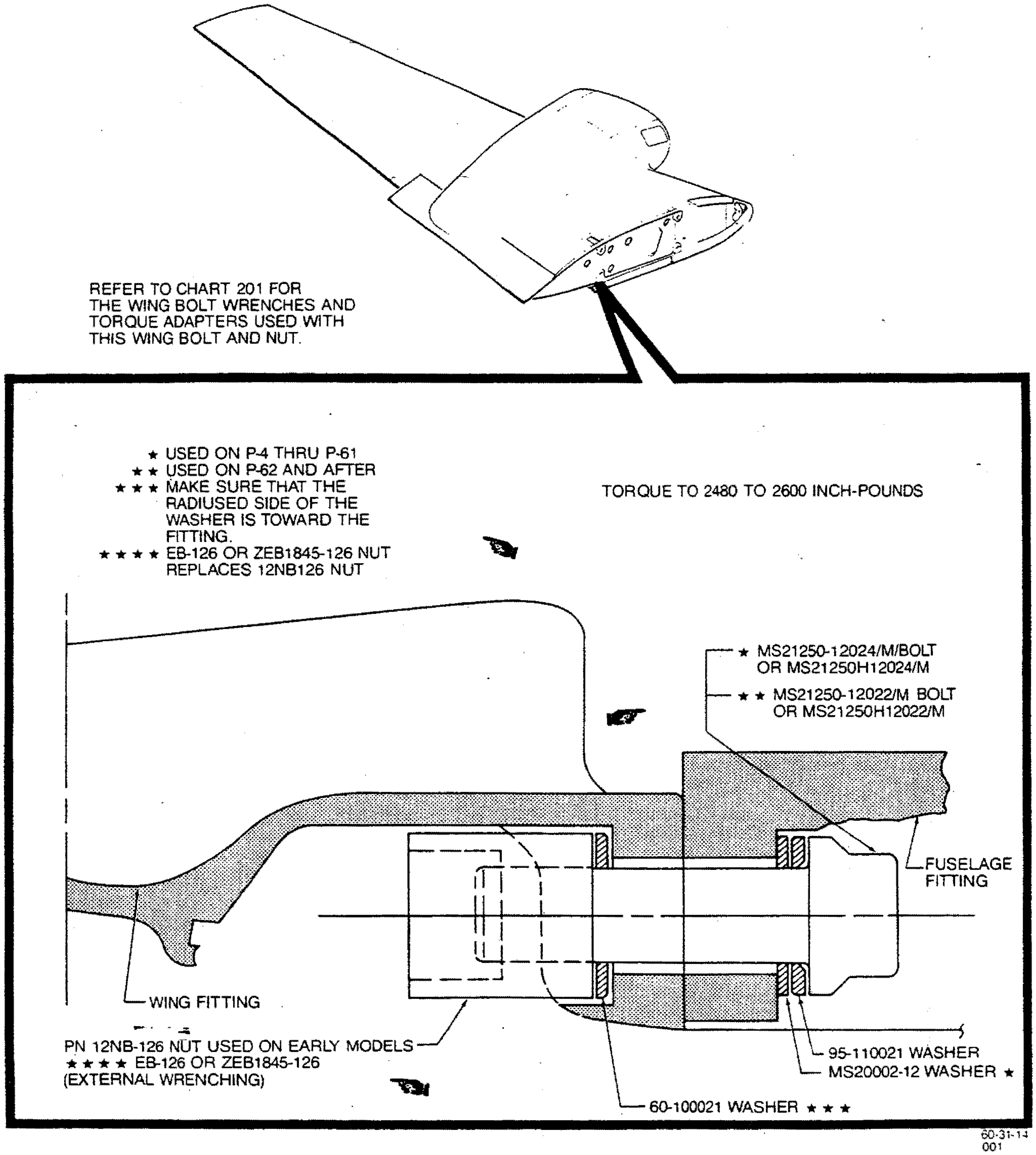
INSPECT THE WING ATTACH FITTINGS TO ENSURE THAT THE DRAIN HOLES ARE CLEAR.

REFER TO CHART 201 FOR THE WING BOLT WRENCHES AND TORQUE ADAPTERS USED WITH THIS WING BOLT AND NUT.

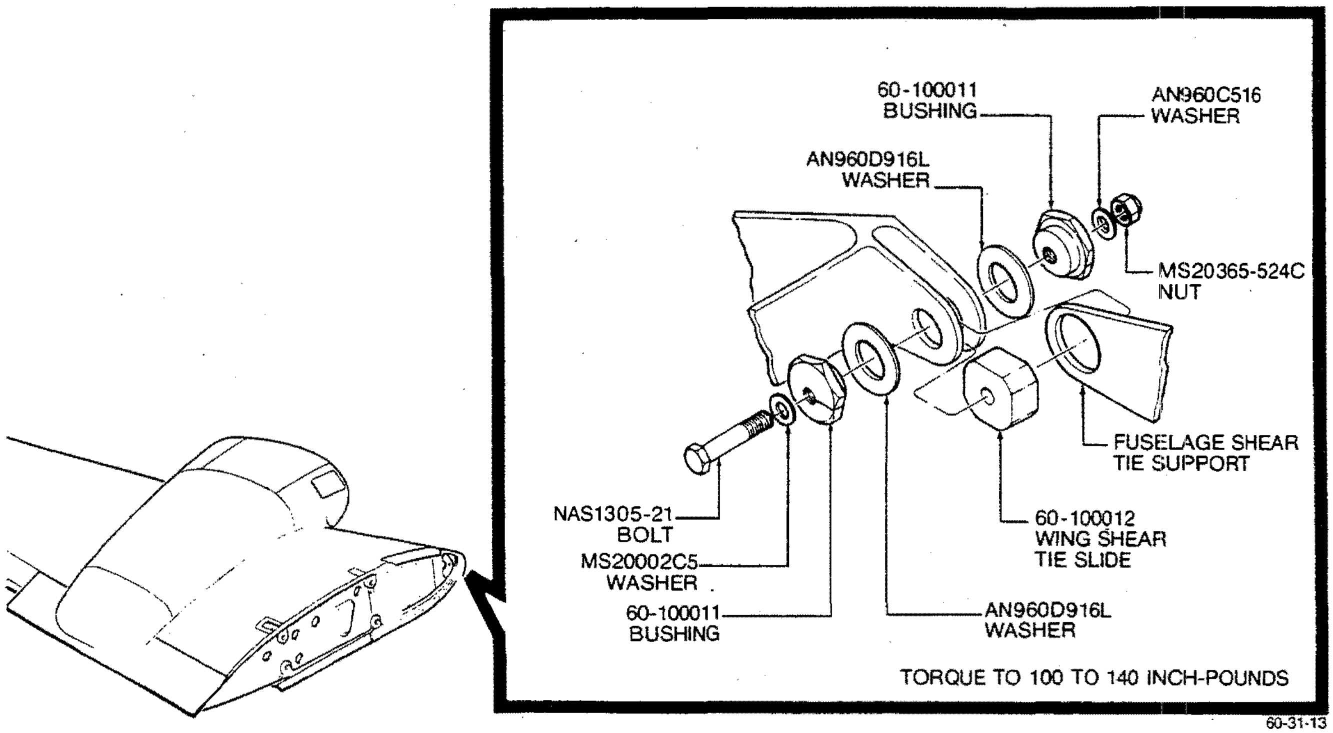
Upper Aft Wing Bolt Installation
Figure 202



Lower Forward Wing Bolt Installation
Figure 203



Lower Rear Wing Bolt Installation
Figure 204



The Forward And Aft Travel Of The 60-100011 Bushings Must Not Exceed .025 Inch, After The Bolt Is Torqued.

Leading Edge Attach Point
Figure 205

h. Install the attaching components in the leading edge fitting. See Figure 205 for proper arrangement of the components. When the components are properly arranged, torque the bolt to the value shown in Figure 205. Check the bushings to assure that the scribe marks align.

CAUTION

Do not lubricate the fittings or attach hardware at the leading edge attach point (Figure 205). The torque value shown in this figure is for dry hardware only.

i. Coat the threads that protrude through the nuts at the forward and aft spar attach points with MIL-C-16173 Grade II corrosion preventive compound (43, Chart 207, 91-00-00).

j. Route the engine control cables along the leading edge, through the engine firewall, and secure in place with clamps.

k. Route the electrical wire bundles along the leading edge and secure in place with clamps, connect wire ends to the terminals on the aft side of the firewall.

l. Connect all fuel, air condition, and deicing plumbing between the wing root and fuselage.

m. Connect the pressurization ducting and fuel selector cable in the leading edge of the wing stub.

n. Install the inboard leading edge cover.

o. Connect the electrical wiring to the fuel boost pump and transmitter.

p. Connect the flap and safety switch wiring in the left wheel well.

q. Connect the flap drive shaft at the flap actuator and clamp the shaft housing to the wing.

r. Install the roll pins in the aileron and aileron trim tab pulley brackets.

s. Install the aileron tab cable stops and connect the aileron cables and the tab cables to the turnbuckles. Rig the aileron control system as instructed in Chapter 27-10-00.

t. Connect the landing gear and the inboard main gear door actuating rods. Check the landing gear rigging as instructed in Chapter 32-30-00.

u. Connect the brake hydraulic line and bleed the brake system as instructed in Chapter 32-40-00.

v. Install the engine as instructed in Chapter 71-00-00.

w. Charge the air condition system with refrigerant as instructed in Chapter 21-50-00.

x. Install all removed access plates and covers.

y. Install the nacelle fairings.

z. Remove the airplane jack and service the fuel cells as instructed in Chapter 12-10-00. Check for fuel leaks.

aa. Perform an engine run-up; check and adjust, a necessary, as instructed in Chapter 71-00-00.

ab. Test fly the airplane, and adjust the wing an engine, as necessary.

ADJUSTING THE WING

After a wing is installed or repaired, flight tests may sho one wing to be chronically heavy. This condition may b corrected by altering the angle of incidence, using th following procedure:

CAUTION

When adjusting the wing, always replace the soft aluminum washers and the 61475-14-43.5 washer assembly at the forward lower wing attach point. Check the torque at the first 100-hour inspection by making certain the center outer ring of the 61475-14-43.5 washer assembly does not turn by finger pressure. Check the remaining wing bolts for proper torque at the first 100-hour inspection after a wing has been installed.

a. Raise the trailing edge of the light wing t decrease its lift as follows:

1. Mark the position of the wing on the re wing bolt fittings.
2. Loosen the mounting nut at the lower re wing fitting. Remove the mounting bolt and nut at the low forward wing fitting. Remove and replace the 61475-14-43 washer assembly at the lower forward attachment a outlined under CAUTION in this procedure ADJUSTIN THE WING. Loosen the mounting bolt on the forward fitting
3. Remove the upper mounting bolt and nu from the two upper wing fittings. Install new aluminu washers between the upper wing and fuselage fitting Raise the wing trailing edge, install the upper wing mountir bolts and nuts and torque all the wing nuts to the specifie torque.
4. Flight test the airplane. If the same wing still heavy, accomplish step "b".

b. Lower the trailing edge of the heavy wing increase its lift as follows:

1. Mark the position of the wing on the re wing bolt fittings.
2. Loosen the mounting bolt nut at the low rear wing fitting. Remove the mounting bolt nut at the low

forward wing fitting. Remove and replace, the 61475-14-43.5 washer assembly at the lower forward attachment as outlined under CAUTION in this procedure. Loosen the mounting bolt on the forward fitting.

3. Remove the upper mounting bolt and nuts from the two upper wing fittings. Install new aluminum washers between the upper wing and fuselage fittings. Lower the wing trailing edge, install the upper wing mounting bolts and nuts, and torque all the wing nuts to the specified torque.

c. If the combination of steps "a" and "b" does not correct the wing heavy condition, rig the flap down on the heavy wing by screwing the actuator out. Do this only as a last resort, since it will create a drag on the airplane.

1. RH Wing Heavy

(a) Disconnect the flap actuator from the flap and screw the actuator arm out to eliminate the wing heavy condition.

(b) Connect the flap actuator to the flap.

2. LH Wing Heavy

(a) Lower the flaps to provide access to flap up limit switch.

(b) Loosen the attaching screws on the flap up limit switch.

(c) Adjust the position of the switch in the elongated holes to rig the flap down enough to eliminate the wing heavy condition.

(d) Tighten the attaching screws on the flap up limit switch.

(e) Disconnect the flap actuator from the RH flaps and screw the actuator arm in to bring the RH flap up to the same position it was before the limit switch was adjusted.

(f) Connect the flap actuator to the RH flap.

Adjust the flaps only as a last resort, since it will create a drag on the airplane.

WING DISASSEMBLY

a. Support the wing on a suitable cradle.

b. Remove the wing tip, aileron, wing flap, fuel cells and other equipment as required by the work to be accomplished.

c. Remove the screws around the spar caps and the root ribs.

d. Vise-grip pliers may be used to remove the steel hinge pins. Remove the pins from the box section first, then the leading edge.

CAUTION

Do not attempt to spin the hinge pins out with a drill motor; the heating and expansion of the pin will cause the pin to seize in the hinge and break.

WING ASSEMBLY
(Figure 207)

a. Before assembling the spar to the wing sections it is advisable to drive the hinge pins through the hinge sections to remove any burrs and foreign material.

b. Use a new hinge pin, liberally coated with graphite (29, Chart 207, 91-00-00).

c. Position the spar on the leading edge and align the hinge sections.

d. Using an E-2, or equivalent size, rivet gun and the telescoping tube kit (P/N 35-588S), drive the hinge pin in until the tip is completely through the hinge, but not against the wing attach fitting. The pin must be supported with the telescoping tubes during the driving operation. Start the pointed end of the pin in the hinge and support the pin with the longest tubes against the hinge, then drive the pin. Remove the tubes as necessary, until the pins are completely inserted. Trim the hinge pins as necessary to extend 4.88 ± .12 inches beyond the end of the spar. Bend the end of the pins at a 90° angle and install retaining plates.

NOTE

It is imperative that the larger tube be held firmly against the hinge throughout the driving procedure in order to prevent the pin from kinking in the intervening space.

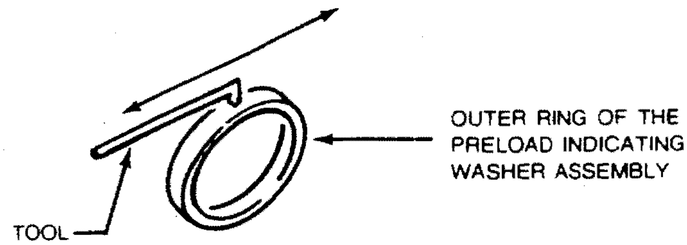
e. Install the box section in the same manner as the leading edge.

NOTE

If necessary, place a phenolic block against the spar and vibrate the spar with another rivet gun.

f. Install the screws around the spar caps and root ribs.

g. Install all components which had been removed.



To tighten the lower forward wing attach bolts, insert the tool into one of the holes in the outer ring of the preload indicating washer assembly. Rotate the ring back and forth while tightening the nut. The bolt is tight when the outer ring can no longer be rotated using 30 · 5 pounds tangential force applied as shown by the symbol above the tool. Do not tighten the bolt beyond this point.

Lower Forward Wing Bolt Tightening Procedure
Figure 206

60-31 15

CHART 201
WING BOLT WRENCHES AND TORQUE ADAPTERS

POSITION	*BOLT PART NO.*	*WRENCH PART NO.*	*NUT PART NO.*	*NUT TORQUE ADAPTER*
UPPER FORWARD	MS21250-12024/M/ or MS21250H12024/M/ or MS21250-12022/M/ or M/S21250H12022/M/	TK1817 922-4	12NB126 (internal wrenching) or EB126 (external wrenching) or ZEB1845-126 (external wrenching)	TS1171-2 or TS1176-2 TS1176-10 or TS1171-10
UPPER AFT	NAS150-38/M/ or NAS150DH38/M/	TS1222-4 or TS1222-8	12NB108	TS1171-1 or TS1176-1 or 50-590013
LOWER FORWARD	MS21250-14034/M/ or MS21250H14034/M/	TK1817 922-5	72789-1414	50-590014
LOWER AFT	MS21250-12024/M/ or MS21250H12024/M/ or MS21250-12022/M/ or M/S21250H12022/M/	TK1817 922-4	12NB126 (internal wrenching) or EB126 (external wrenching) or ZEB1845-126 (external wrenching)	TS1171-2 or TS1176-2 TS1171-10 or TS1176-10

METAL STALL STRIPS

The stall strips installed on airplanes without wing deicer boots are manufactured from clad 6063 aluminum alloy extrusion and riveted to the leading edge. A 10.50-inch strip is located outboard of wing station 123.06 on the left wing, and a 7.62-inch strip is located outboard of wing station 122.93 on the right wing.

WING BOLT NUT AND FITTING INSPECTION

NOTE

Read this entire section before removing any wing bolt for inspection.

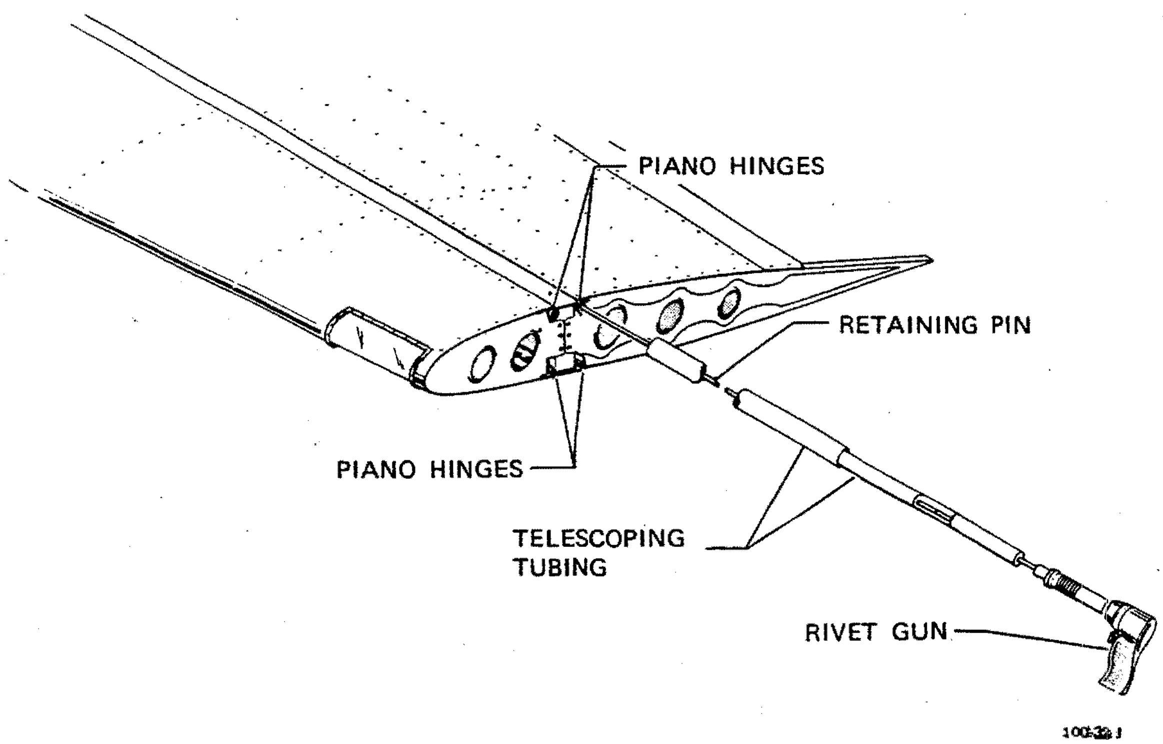
WARNING

The wing bolts and nuts installed in all Model 60 (Duke series) airplanes that are five years old or older must be removed and inspected. If the bolts and nuts prove to be free of all damage, they may be reinstalled for an additional five year period. At the end of this period the bolts and nuts must again be removed and inspected. Ten years after the initial inspection, all wing bolts and nuts must be replaced with new hardware. Render unserviceable all components removed in compliance with Chart 202.

a. Before removing any wing bolt, draw an outline of the wing position on the fuselage with a grease pencil. If wing bolt binding is encountered and the wing must be shifted, the outline will be helpful in returning the wing to its original position.

CAUTION

There should be no wing bolt binding during removal or installation of the bolts. Do not screw or drive a bolt in or out of the fittings. If wing bolt binding is encountered, place the airplane on a three point jack and raise until the wheels are clear (see Chapter 7-00-00 for jacking



Wing Hinge Pin Installation
Figure 207

instructions). Place a wing stand under each wing and a tail stand under the aft fuselage. Defuel the wing, loosen the remaining three bolts and rotate the wing until the binding bolt moves freely through the fittings. Replace the soft aluminum washers between the upper wing attach fittings and the preload indicating washer under the nut at the lower forward wing attach point. Retorque the nuts in the order outlined in this chapter under WING INSTALLATION.

NOTE

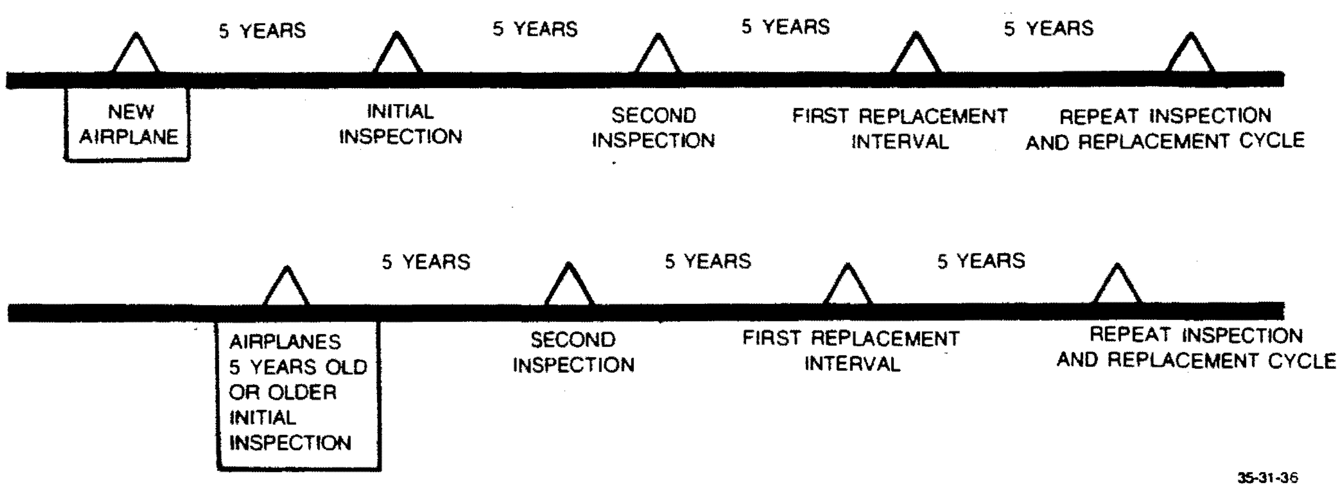
Beech Aircraft Corporation supplies hardware that has been given an additional magnetic particle inspection since manufacture. These components may be identified by the green dye on the head of the bolt and on some portion of the nut.

WARNING

Use only the components specified in the applicable illustrations. DO NOT INSTALL THE BLACK P/N H20 NUTS; these nuts have been dry film lubricated with molybdenum disulfide. When MIL-C-16173 Grade II corrosion preventive compound is added to these nuts, the additional lubrication may cause improper preload in the bolt when it is torqued.

b. Starting at the lower forward wing attach point on each side, remove, inspect, and retorque one bolt and nut set at a time until the complete set of eight bolts and nuts have been inspected. The leading edge attach fittings and hardware (Figure 205) ARE NOT a part of this inspection requirement.

c. Using a nonmetallic brush, thoroughly clean the bolt, washers, and nut with naphtha or methyl ethyl ketone (20 or 21, Chart 207, 91-00-00).



NOTE

The first inspection for airplanes five years old or older must be performed at the first scheduled inspection following the issue date of revision A14.

NOTE

At each replacement interval, all wing attach bolts, washers, and nuts must be replaced with new hardware.

Wing Bolt And Nut Inspection And Replacement Cycle
Chart 202

CAUTION

Assure that the radiused washers shown in Figures 201, 202, 203 and 204 have a full radius with no sharp edges that could damage the wing fittings.

d. If the bolts and nuts do not exceed the life limit shown in Chart 202, visually inspect each bolt and nut with a 10-power or stronger magnifying glass; inspect for corrosion, cracks and mechanical damage. The cadmium plating may have areas that appear rubbed, discolored or polished. These areas are usually the result of previous installation procedures and are of no consequence. A bolt should not be rejected because of cadmium plating deterioration; however, any component that is cracked, corroded or shows signs of mechanical damage must be replaced.

e. Using the magnetic particle inspection process described in this chapter, check each bolt for circumferential crack indications and each nut for longitudinal crack indications. If the bolts and nuts prove to be free of all damage (corrosion, cracks, and mechanical damage), they may be reused after demagnetization and cleaning.

f. Clean the fitting bolt bores with naptha or methyl ethyl ketone (20 or 21, Chart 207, 91-00-00). Do not strip the epoxy paint from this area. Inspect the surface condition of each fitting; focus special attention on the washer seat and bolt bore area. If scoring, corrosion pitting or washer impressions are discovered in this area, contact the Commercial Service Department of Beech Aircraft Corporation. If the fittings are satisfactory, coat the bolt bores and bearing faces with Alodine 1200, 1200S or 1201 (48, Chart 207, 91-00-00). Allow the coating to remain on the surface for approximately five minutes. When the approximate time has elapsed, wash the treated areas with water and blow dry (do not wipe dry). Paint the treated areas with zinc chromate primer (26, Chart 207, 91-00-00) and allow to dry.

g. Coat the bearing faces and bolt bores of the fittings, the complete bolt, washers, and nut with MIL-C-16173 Grade II corrosion preventive compound (43, Chart 207, 91-00-00).

h. Install the bolts, washers and nut into the fittings.

CAUTION

Ensure that the wing bolt wrenches do not bottom out on the wing fittings when torquing the nut. This could result in damage to the wing fittings and erroneous torque readings.

i. Torque the nut to the wet torque value shown in the appropriate illustration (Figure 201, 202, 203 or 204). When a torque wrench adapter is used, the length of the adapter must be added to the length of the torque wrench and the proper torque value computed as detailed in Chapter 20-00-00.

j. Coat the exposed threads that protrude through the nut with MIL-C-16173 Grade II corrosion preventive compound (43, Chart 201, 91-00-00).

k. Check that the decal shown in Figure 208 is affixed to the appropriate locations on the airplane.

l. At the first scheduled inspection after the wing bolts have been inspected or replaced, check each bolt for proper torque and inspect the drain holes in the upper wing fittings to assure that they are unobstructed.

MAGNETIC-PARTICLE INSPECTION

Magnetic-Particle Inspection is a method for locating surface and subsurface discontinuities in ferromagnetic materials (i.e. materials capable of being magnetized); consequently, nonferromagnetic materials (such as aluminum alloys, magnesium alloys, copper alloys, lead, titanium alloys, nickel base alloys and many stainless steel alloys) cannot be inspected by this method. Magnetic-Particle Inspection is based upon the principle that any discontinuities lying in a direction generally transverse to the direction of the magnetic field of the part magnetized for the test will cause a leakage field to be formed at and above the surface of the part. The presence of the leakage field denoting the discontinuity is detected by the use of finely divided ferromagnetic particles over the surface of the part. Some of the particles are magnetically gathered and held by the leakage field to form an outline indicating the location, size, shape and extent of the discontinuity. In general, magnetic particle inspection utilizes a variety of types of equipment for magnetization, as well as several methods for application of ferromagnetic particles to the test part. Additionally, the ferromagnetic particles are available in a selection of colors (including fluorescent) and particle shapes. Magnetic particle inspections required by this manual can best be accomplished by utilizing the "wet continuous method" on the standard wet horizontal type equipment, with either visible or fluorescent magnetic particles suspended in a petroleum base vehicle (normally kerosene). Since magnetic particle indications are best obtained when the discontinuity lies in a direction transverse to the magnetic field, the following procedures are recommended for optimum detection of discontinuities in both bolts and nuts.

NOTICE

**WING BOLTS ARE LUBRICATED
SEE MAINTENANCE MANUAL
FOR CORRECT TORQUE VALUES**

WHEN THE CORROSION PREVENTIVE COMPOUND HAS BEEN APPLIED TO THE WING BOLTS, AFFIX THE ABOVE DECAL TO THE FOLLOWING LOCATIONS:

1. On the side of the fuselage immediately above the RH forward and aft wing bolt covers.
2. On the wing immediately forward of the LH forward and aft wing bolt covers.
3. On the wing immediately forward of the lower forward wing bolt covers on both sides.
4. On the wing immediately aft of the lower aft wing bolt covers on both sides.

**Lubricated Bolt Identification Placard Location
Figure 208**

WARNING

Improper operation of the magnetic particle inspection because of faulty equipment or untrained operators can jeopardize the airworthiness of parts being inspected. Minute electrical arc burns caused during inspection by improper operation of the test equipment can result in eventual failure of the part.

Bolts: Inspection of a bolt is accomplished by longitudinal magnetization in a multiturn low-fill factor coil (i.e. the inner diameter of the coil greatly exceeds the bolt diameter). For proper magnetization the bolt is positioned close to the coil inside wall with the bolt length perpendicular to the winding direction. The magnetic particle suspension is flowed on the bolt and the appropriate current is applied to achieve adequate field strength. Using the described procedure, laboratory testing has indicated that the ampere turn values listed in Chart 203 provide for optimum detection of discontinuities perpendicular to the bolt axis.

**CHART 203
MAGNETIC-PARTICLE INSPECTION
(BOLTS)**

BOLT DIAMETER	*TOTAL BOLT LENGTH INCLUDING HEAD TO NEAREST 1/4 INCH*	*AMPERE TURNS*
5/8 INCH	2 1/2 INCH	7900
5/8 INCH	2 3/4 INCH	7100
5/8 INCH	3 INCH	6600
3/4 INCH	3 INCH	7900
3/4 INCH	3 1/4 INCH	7400
3/4 INCH	3 1/2 INCH	6700
3/4 INCH	3 3/4 INCH	6300
7/8 INCH	3 1/2 INCH	7900
7/8 INCH	3 3/4 INCH	7400
7/8 INCH	4 INCH	6900
7/8 INCH	5 INCH	5500
1 INCH	5 INCH	6300

*Amperage requirement is the ampere turns value divid by the number of turns on the coil. For example: A 1-in diameter x 5-inch long bolt tested on a 5-turn coil wo require 6300 ÷ 5, or 1260 amps.

CHART 204
MAGNETIC-PARTICLE INSPECTION
(NUTS)

NUT SIZE	*CENTRAL CONDUCTOR SIZE*	*AMPERAGE*
5/8 INCH	1/2 INCH	500 AMPS
3/4 INCH	5/8 INCH	600 AMPS
7/8 INCH	3/4 INCH	700 AMPS
1 INCH	7/8 INCH	800 AMPS

Nuts: Inspection of a nut is accomplished by circular magnetization on a central conductor (usually a copper rod) the approximate size of the nut inside diameter. For proper magnetization, the central conductor bar is inserted through the nut and the bar is positioned between the heads of the wet horizontal equipment. The magnetic particle suspension is flowed on the nut and the appropriate current is applied through the central conductor to achieve adequate field strength. Using the described procedure, laboratory testing has indicated that the amperage values listed in Chart 204 provide for optimum detection of discontinuities parallel to the nut axis.

After magnetic particle inspection, the parts must be carefully demagnetized and cleaned of the ferromagnetic particles. Examine parts for any possible evidence of electric arc bum that may have occurred during the inspection.

WING MAIN SPAR CAP INSPECTION

The outboard wing main spar caps must be inspected for corrosion annually.

WARNING

All areas of the upper and lower spar caps must be inspected from the attach fitting to the outboard end.

BEECHCRAFT KIT NO. 58-4002-1S provides the parts and information necessary to install a new 000-110011-7 LH spar and a new 000-110011-8 RH spar on the 60 and A60 series airplanes. The kit does not contain the spars which must be ordered separately. Parts for installing new spars on the B60 series airplanes may be ordered from the Model 60 series parts catalog.

NOTE

Special emphasis should be placed on airplanes that have been operated or stored for extended periods (5 years or longer) in geographical locations where atmospheric conditions are highly conducive to corrosion.

Inspection of the upper and lower spar caps should be accomplished in the following manner:

a. Examine the forward and aft sides of the spar cap where it meets the skin. If a whitish, salt-like, nonmetallic substance is noted in these areas, a thorough inspection must be performed to determine if corrosion has occurred. Wax or paint trapped between the edge of the skin and the exposed section of the spar cap should not be misinterpreted as corrosion.

NOTE

To gain access to the upper spar caps in the nacelle area, remove the solid black panels shown in Figure 210.

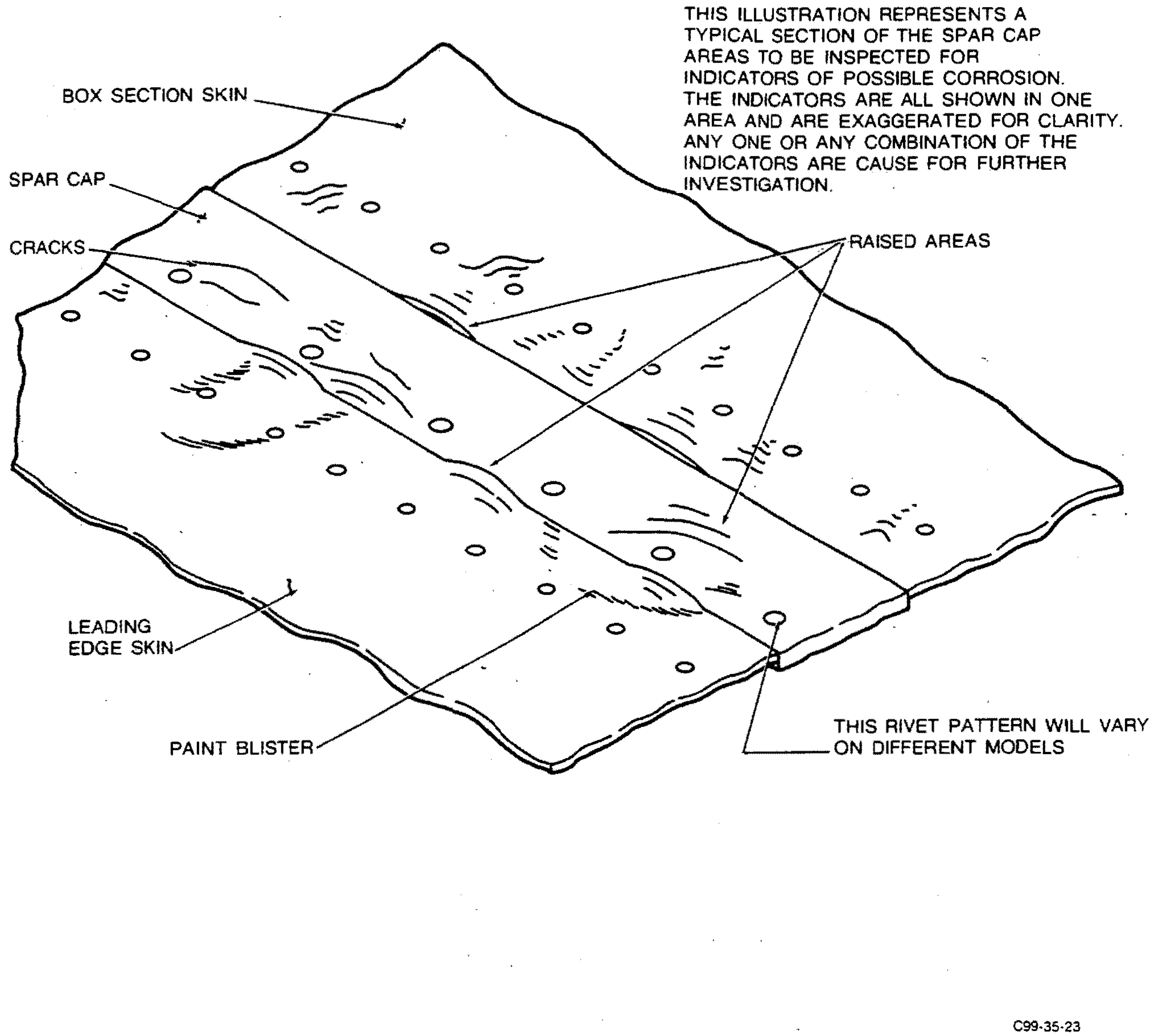
b. Wash all exposed areas of the upper and lower spar caps.

c. Visually inspect all exposed areas of the upper and lower spar caps for irregularities, such as paint blisters, raised or uneven areas, and cracks. The exposed areas of the spar caps are extruded flat and irregularities could be an indication of corrosion. Thoroughly investigate all irregular areas to determine if any damage has occurred.

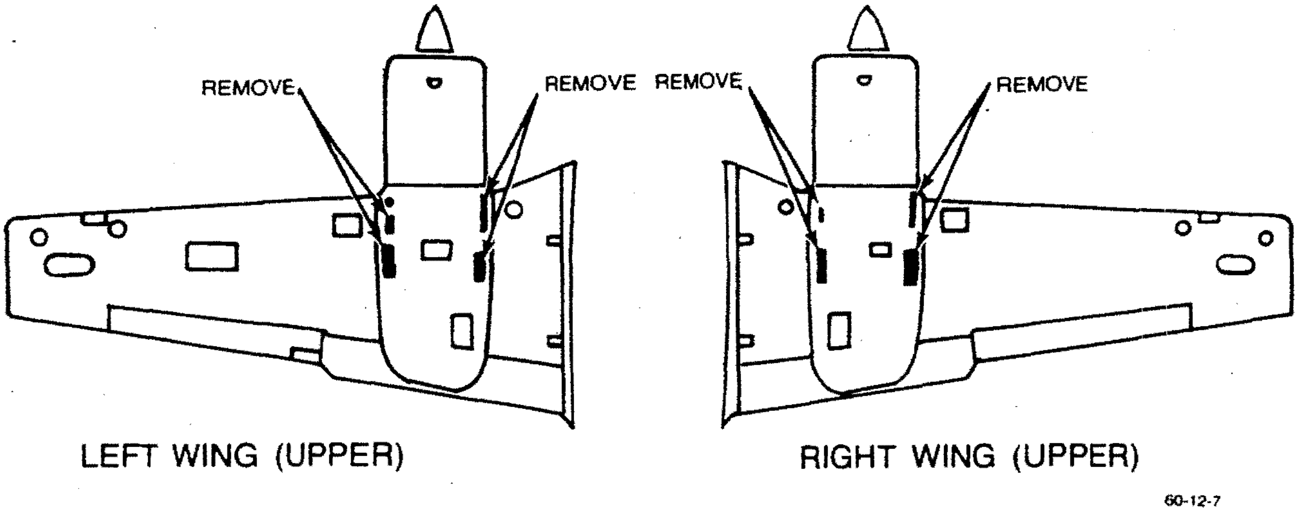
NOTE

Uneven or raised areas on the spar caps may be detected by sliding the fingers over the surface, by moving a straight edge over the surface or by sighting down the length of the spar cap surface.

d. If unusual conditions are encountered that cannot be resolved locally, contact the Commercial Service Department of Beech Aircraft Corporation for evaluation and determination of any corrective action that may be required.



Spar Cap Inspection
Figure 209



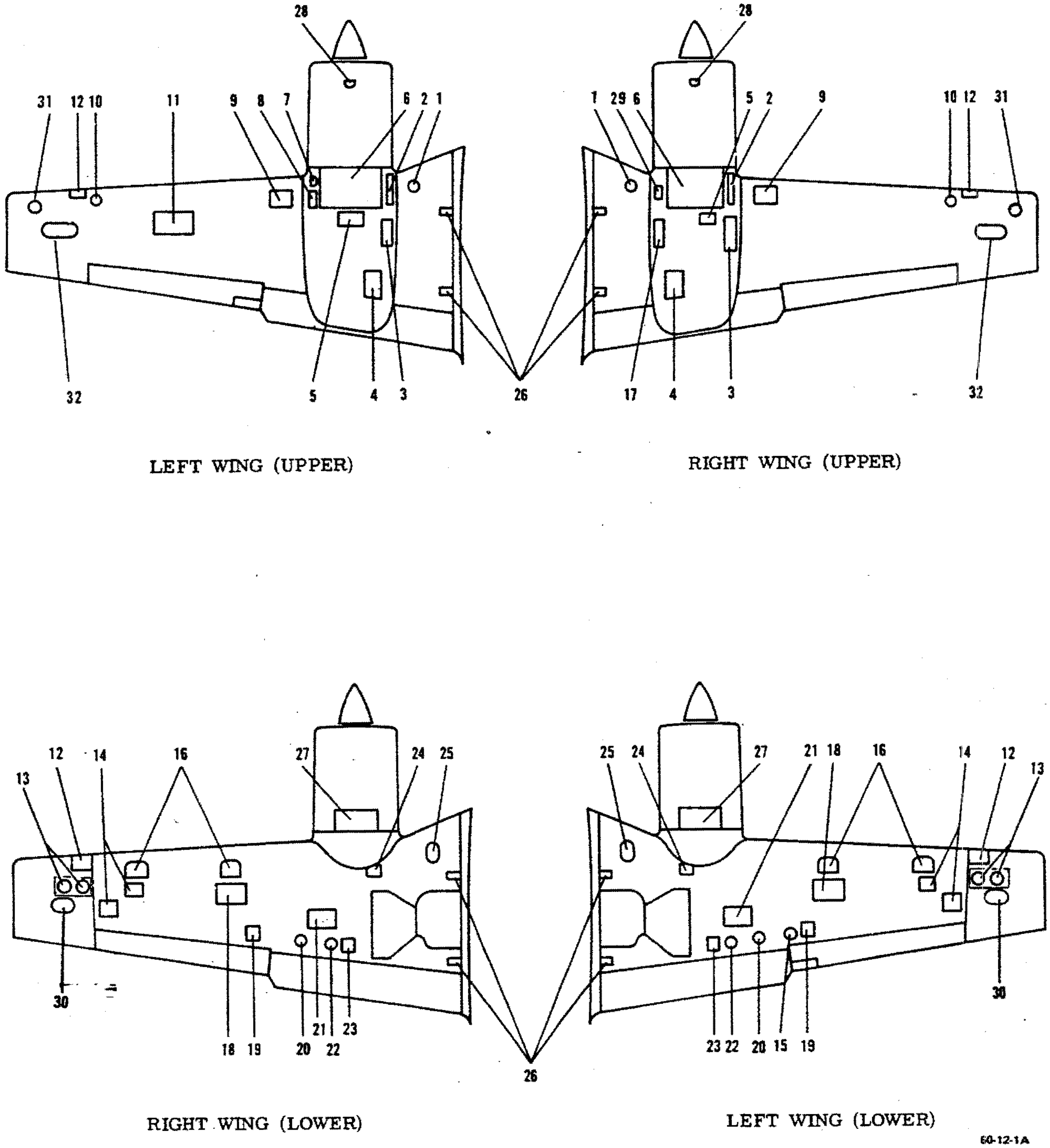
Upper Spar Cap Access Panels
Figure 210

"END"

PLATES/SKIN-MAINTENANCE PRACTICES

WING ACCESS OPENINGS

The panels, plates and doors as shown in Figure 201, provides maintenance access to the components, plumbing and cables enclosed within the wing. When installed, they continue the aerodynamic lines of the wing with little increase of drag.



Wing Access Openings
Figure 201 (Sheet 1 of 2)

1. Leading Edge Fuel Cell Transmitter
2. Alternate Air and Fuel Pressure Solenoid
3. Nacelle Fuel Cell Transmitter and Plumbing
4. Nacelle Fuel Cell and Vent Line Plumbing
5. Fuel Vent Check Valve and Plumbing
6. Battery, Battery Relays, Voltage Regulators, Overvoltage Relays, Starter Relays, Paralleling Rheostat, Fuel Flow Inverter, Load Meter Shunt, Fuse Block, Radio Inverter, Radio Inverter Circuit Breaker and Relay, External Power Diode and Current Limiter for Battery
7. External Power Plug
8. Reverse Current Diode, External Power and LH Control Relay
9. Leading Edge Fuel Cell Transmitter and Fuel Cell Installation
10. Fuel Filler
11. Remote Compass
**12. Landing Light
* 13. Wing Tip Tiring and Fuel Vent Float Valve
14. Fuel Siphone Valve
15. Aileron Tab Actuator
16. Leading Edge Fuel Cell
17. Nacelle Fuel Cell Plumbing
18. Box Section Fuel Cell
19. Aileron Actuator and Pulleys
20. Aileron Cable, Fuel Vent and Battery Vent
21. Box Section Fuel Cell
22. Fuel Vent Line and Aileron Tab Cable
23. Fuel Vent Line
24. Landing Gear Attach Bolt
25. Fuel Boost Pump
26. Wing Attach Bolt
27. Cowl Flap
28. Oil Level Indicator
29. Reverse Current Diode
**30. Remote Compass Detector
†31. Fuel Filler
†32. Wing Tip Access Opening

* One (1) retangular opening on P-223 and after without wet wing tip
** P-223 through P-347, P-349 through P-364
† Optional P-348, P-365 and after

Wing Access Openings
Figure 201 (Sheet 2 of 2)

"END"

ATTACH FITTINGS - MAINTENANCE PRACTICES

The major fittings in each wing are the supporting structures adjacent to the attachment points for the flap actuator, flap tracks and flap, the aileron hinge brackets and hinges, the main landing gear, support brace and landing gear doors, and the engine mount. Minor fittings include brackets to support cable pulleys, bell cranks, and similar components. The main gear is bolted to heavy aluminum alloy fittings attached to the main and rear spar. The support brace is attached in the same manner. If the landing gear hinge bolt fittings are cracked, or if the spars are warped or buckled, replacement is necessary.

WING FRONT SPAR CAP INSPECTION

Perform this inspection on all Dukes, which are 5 years or older, in the areas and by the methods defined in Service Instructions No. 0514-035, Rev. 1.

"END"

FLIGHT SURFACES - MAINTENANCE PRACTICES

BALANCING THE AILERON (Figure 201)

When the aileron control surface is being repainted, suspend it by the trailing edge so that excess paint will drain toward the leading edge. After any repainting or repair, the finished surface must be check balanced to ensure that its static moment about the hinge line is within the prescribed limits.

NOTE

> The finished aileron assembly, with static discharge wicks (if required) installed, must have a static overbalance of between 0.2 and 3.0 inch-pounds.

The static moment of the aileron is determined by multiplying the unbalanced weight of the aileron assembly times the perpendicular distance from the hinge center line to the center of gravity when the chord line is horizontally level. The weight is measured in pounds and the distance in inches. The static moment of a 100 percent balanced control surface is 0.0 inch-pounds. A tail-heavy surface exhibits static underbalance. A nose-heavy surface exhibits static overbalance.

CHECKING BALANCE

The aileron balance must be checked in a draft free area with the aileron completely assembled in flying condition. All painting, including stripes and touch-up, must be completed. The tab, tab push rod, static wicks, and hinge bolts must be attached. The chord line must be horizontally level and the hinge line must be properly supported when the static moment is measured. Although many different methods of check balancing exist, the simplest is counterbalancing: The application of a known force or weight at a measured distance from the hinge line to counter the unbalance moment of the aileron assembly.

EQUIPMENT REQUIRED TO PERFORM CHECK BALANCING BY COUNTERBALANCING METHOD

a. A stand with knife edge supports as illustrated in Figure 201. The knife edges must be in the same horizontal plane.
b. A cup or similar light weight container.
c. Approximately 1 pound of lead shot.
d. A certified beam balance weighting device calibrated in units of .01 pound or less.
e. A straight edge, ruler, and spirit level.

BALANCING PROCEDURE

COUNTERBALANCING METHOD

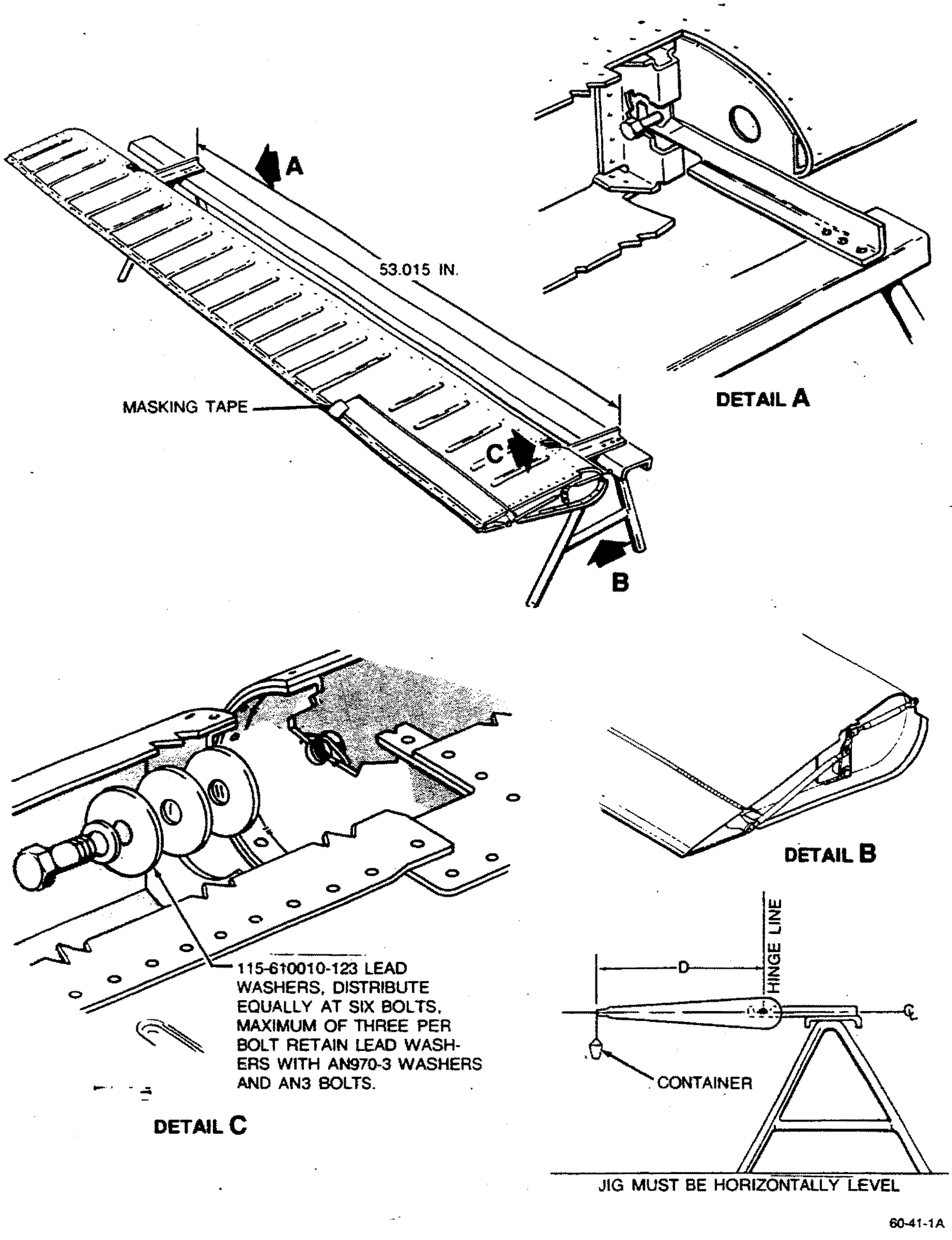
a. Locate the chord line by placing a straight edge at the inboard end of the aileron assembly so that one end is on the trailing edge and the other end is centered on the leading edge. Mark the chord line with a suitable marker such as a grease pencil, then remove the straight edge.
b. Secure the trim tab (LH only) in its neutral position with a small piece of masking tape.
c. Fit the correct size bolts in the hinge brackets and mount the aileron on the knife edge supports. Ensure that the aileron is free to rotate about the hinge line.
d. To determine if weight should be added or removed, suspend a cup from a point near the center of the aileron trailing edge. Use a short length of small diamter string secured to the surface with a small piece of masking tape. (See Figure 201.) The cup must be free to hang vertically.
e. Add small quantities of lead shot to the cup until the aileron balances with the chord line level. Check this by holding the spirit level aligned with the marked chord line.
f. The distance "D" must be perpendicular to the hinge line. Measure "D" from the hinge line to the suspension point of the cup.
g. Remove the cup, contents, and string, then weight them.

NOTE

> Since any weighing error is magnified by the distance "D", weighing is most important and must be done carefully on scales that are certified for accuracy.

h. Calculate the static balance as follows:

1. The weight of the cup and contents is designated by "W".
2. The overbalance moment is designated by "M".
3. M = W x D.
4. The following is a typical example of a balancing calculation: If the aileron balances with the chord line level at "W = .15 pound" and "D = 10.0 inches", then . . .



Balancing the Aileron
Figure 201

M = .15 x 10.0

M = 1.50 inch-pounds. The product of "W x D".

In this instance, "M" is within the required static balance range and is therefore acceptable.

i. If the static balance is not as noted in BALANCING THE AILERON, in this chapter, add or remove the lead washers as needed to attain the desired balance.

NOTE

A maximum of three lead washers (115-610000-123) may be added on each of six AN3 bolts near the leading edge, to bring the aileron balance within limits. Equally distribute and attach the washers with AN3 bolts of suitable length, and use one AN970-3 washer between the head of bolt and lead washer (see Figure 201).

"END"

CHAPTER 61

LIST OF PAGE EFFECTIVITY

"END"

CHAPTER 61 - PROPELLERS

TABLE OF CONTENTS

"END"

GENERAL - DESCRIPTION AND OPERATION

PROPELLERS

On airplanes P-3 thru P-384, P-387, P-402 and P-403, the engines are equipped with 74 inch Hartzell HC-F3YR/C7479-2R or HC-F3YR-2F/FC7479-B2R three bladed, full feathering, constant speed, air dome propellers. Centrifugal force from the propeller counterweights, assisted by air pressure in the propeller dome, moves the blades to high pitch. Engine oil under governor-boosted pressure moves the blades to low pitch. On airplanes P-385, P-386, P-388 and after except P-402 and P-403, the engines are equipped with 74 inch Hartzell HC-F3YR-2UF/FC7479B-2R three bladed, full feathering, constant speed, air dome propellers. Centrifugal force from the propeller counterweights, the feather assist spring, and air pressure from the propeller dome moves the blades to high pitch. Engine oil under governor-boosted pressure moves the blades to low pitch. The propeller hub area and the air dome are enclosed by a spinner and bulkhead assembly.

PROPELLER SYNCHRONIZER

The propeller synchronizer automatically matches the left "slave" propeller rpm to that of the right "master" propeller. To prevent the left propeller from losing excessive rpm if the right propeller is feathered while the synchronizer is on, the synchronizer operation is limited to approximately ± 30 rpm from the manual governor setting. Normal governor operation is unchanged but the synchronizer will continuously monitor propeller rpm and reset the governor as required.

A magnetic pickup mounted in each propeller governor transmits electric pulses to a transistorized control box installed behind the pedestal. The control box converts any pulse rate differences into correction commands, which are transmitted to a stepping type actuator motor mounted on the left engine compressor mounting bracket. The motor then trims the left propeller governor through a flexible shaft and trimmer assembly to exactly match the right propeller rpm. The trimmer, installed between the governor control arm and the control cable, screws in or out to adjust the governor while leaving the control lever setting constant.

A toggle switch installed on the pedestal turns the system on. With the switch OFF, the actuator automatically runs to the center of its range of travel before stopping to assure that when next turned ON, the control will function normally.

To operate the system, synchronize the propellers in the normal manner and turn the synchronizer ON. The left propeller rpm will automatically be adjusted to correspond with the right. To change rpm, adjust both propeller controls at the same time. This will keep the left governor setting within the limiting range of the right propeller. If the synchronizer is ON but is unable to adjust the left propeller rpm to match the right, the actuator has reached the end of its travel. Turn the synchronizer switch OFF (allowing the actuator to run to the center of its range and the left propeller to be governed by the propeller lever), synchronize the propellers manually, and turn the synchronizer switch ON.

PROPELLER SYNCHROSCOPE

A propeller synchroscope, located in the tachometer case, operates to give an indication of synchronization of propellers. If the right propeller is operating at a higher rpm than the left, the face of the synchroscope, a black and white cross pattern, spins in a clockwise rotation. Left or counterclockwise, rotation indicates a higher rpm of the left propeller. This instrument aids the pilot in obtaining complete manual synchronization of the propellers.

"END"

TROUBLESHOOTING
PROPELLER SYNCHRONIZER

TROUBLE	PROBABLE CAUSE	REMARKS
1. Synchronizer inoperative.		
a. Circuit breaker trips.	a. Short in aircraft wiring.	a. Isolate and repair faulty component.
b. Intermittent readings on pins 6 & 8 or 7 & 8 (circuit breaker may also trip).	b. Intermittent short or open magnetic pickup in governor.	b. Repair or replace magnetic pickup.
c. Slave (left) governor pickup gives open or short circuit reading on pins 6 & 8	c. Broken or grounded wire in magnetic pickup or slaved governor.	c. Repair or replace magnetic pickup.
d. Master (right) governor pickup gives open or short circuit reading on pins 7 & 8.	d. Broken or grounded wiring magnetic pickup of master governor.	d. Repair or replace magnetic pickup.
2. Poor synchronization.		
a. Pickup voltage exceeds 3 volts at cruise rpm.	a. Insufficient pickup to flyweight head clearance.	a. Reset pickup to give specified voltage output.
b. Pickup voltage is less than .5 volt at cruise rpm.	b. Clearance between pickup and flyweight head too great.	b. Reset pickup to give specified voltage output.
c. Synchronizer pulses out of synchronization when turned on but returns to center when turned off.	c. Leads No. 3 and No. 4 reversed or master and synchronizer leads reversed at Jones plug.	c. Rewire correctly.
d. Synchronizer pulses out of synchronization when turned on but returns to center when turned off and pins 6 & 8 or 7 & 8 have fluctuating readings.	d. Intermittent open or short in pickup or wiring.	d. Replace faulty pickup or wiring.
e. Synchronizer action is sluggish.	e. Excessive friction in trimmer or flexible rotary shaft.	e. Clean, lubricate, and check for misalignment of shaft in guide tube.
f. Synchronizer action too limited in range.	f. Excessive friction at one end of trimmer or actuator and trimmer were not centered when flexible rotary shaft was connected.	f. Clean, lubricate, and check for misalignment, recenter actuator and rod end, and reengage shaft.
3. Actuator inoperative but magnetic pickups and control box function properly.	a. Shorted or open actuator motor winding.	a. Replace.

TROUBLESHOOTING
PROPELLER SYNCHRONIZER (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
4. Actuator not recentering.		
a. Actuator will not return to center after shutting synchronizer control off in flight.	a. Defective centering mechanism in actuator or incorrect clearance between flyweight head and pickup.	a. Replace actuator or reset magnetic pickup output as necessary.
b. Actuator has improper travel (should make 3 revolutions).	b. Defective centering mechanism in actuator.	b. Replace.
c. Actuator dead band determined by ohmmeter (pins 5 and 1 open circuit) is 7 to 26 steps wide (actuator will probably not recenter when switch is turned off).	c. Actuator switches stuck in depressed position.	c. Replace.
5. Oil leaks from magnetic pickup connection in governor body.	a. Defective O-ring between pickup and lock nut.	a. Replace.
	b. Defective gasket under lock nut.	b. Replace.
	c. Nut loose.	c. Tighten to 25 inch-pounds.
	d. Defective pickup.	d. Replace pickup.

CAUTION

Never turn pickup into flyweight head. Check voltage output.

"END"

GENERAL - MAINTENANCE PRACTICES

PROPELLER BLADE BEARING LUBRICATION
(Figure 201)

a. Remove the propeller spinner dome.

b. Remove the safety wire and covers from the six zerks.

c. Remove one zerk from each blade.

d. Lubricate the blade bearings with Hartzell DG Grease by placing the grease gun fitting on the remaining zerk of each blade. Fill until the grease is visible in the hole where the opposite zerk was removed.

e. Reinstall the zerk on each blade.

f. Clean excess grease from the propeller, reinstall the grease zerk covers and safety.

g. Reinstall the spinner dome.

PROPELLER REMOVAL

a. Remove the attaching screws and remove the spinner dome and cap.

b. Remove the retaining screws and the nose cowling fairing channels from the base of the propeller hub.

c. Remove the safety wire and remove the nuts around the propeller hub base with the special propeller torque wrench adapter (P/N 922 60-960000).

NOTE

When propeller deicer equipment is installed, it is necessary to disconnect the terminal wires on the starter ring gear.

d. Pull the propeller carefully from the mounting studs.

CAUTION

Do not damage the threads on mounting studs and be careful not to damage the spinner.

PROPELLER INSTALLATION

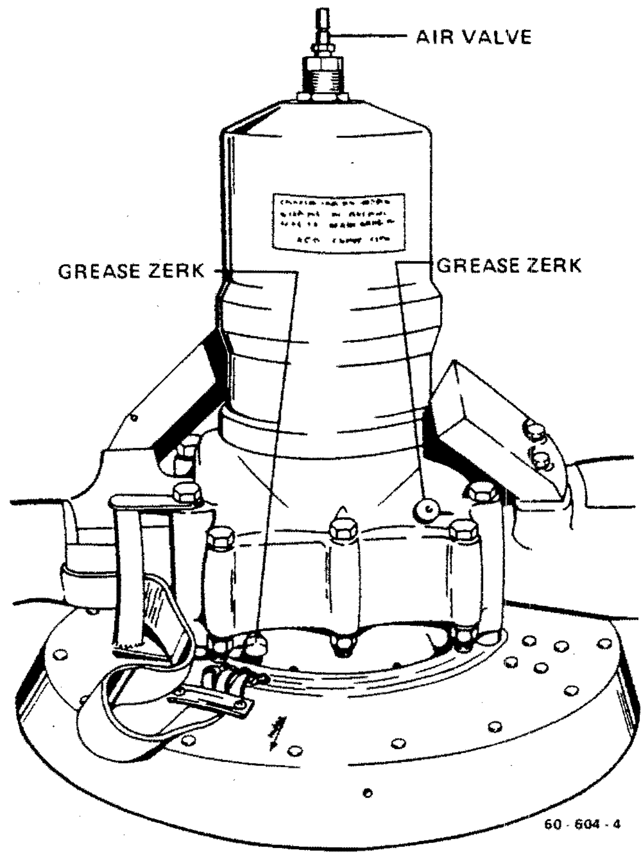
a. Install a new O-ring in the propeller flange extension and carefully position the propeller on the mounting studs. Install nuts and washers and snug down in a diagonal pattern. Torque nuts to 90 to 100 foot-pounds and safety wire.

CAUTION

Do not damage the threads on mounting studs and be careful not to damage the spinner.

NOTE

When using the special propeller torque wrench adapter, the torque valve must be recomputed. (Refer to Chapter 20-00-00.)



Propeller Servicing Point
Figure 201

b. Connect propeller deicer terminal wires, if installed, on the starter ring gear.

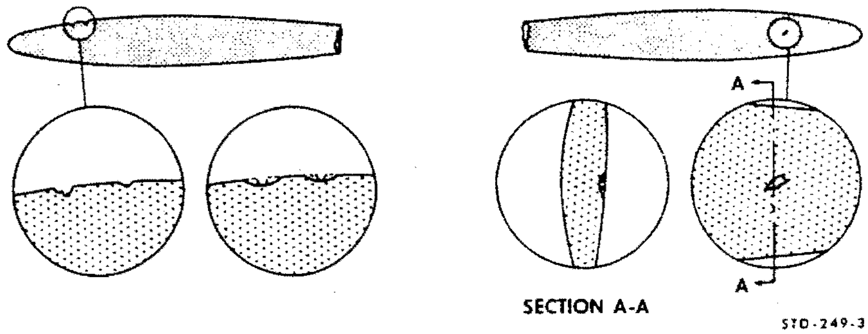
c. Install the nose cowling fairing channels with attaching screws.

d. Position the spinner dome and cap, and install the attaching screws.

e. Connect a dry air or nitrogen supply line to the air valve and fill to 80 psi for HC-F3YR-2/C7479B-2R, HC-F3YR-2F/FC7479-2R, HC-F3YR-2/C7479-2R, or HC-F3YR-2F/FC7479B-2R propellers. This should be done at 70 degrees F. Increase 2 psi for every 10 degrees of temperature increase. Decrease 2 psi for every 10 degrees of temperature decrease. Fill to 41 psi for HC-F3YR-2UF/7479-2R or HC-F3YR-2UF/FC7479B-2R propellers. This should be done at 70 degrees F.

NOTE

70 to 100 degrees F. Pressurize dome to 41 psi
40 to 70 degrees F. Pressurize dome to 38 psi
0 to 40 degrees F. Pressurize dome to 36 psi



Minor Propeller Blade Repair
Figure 202

PROPELLER BLADE REPAIR.
(Figure 202)

Minor nicks, dents and gouges may be dressed out by approved line personnel. Blend any nicks or gouges into the leading edge with smooth curves, and generous radii as shown in Figure 202. Reanodize the reworked area by the chromic acid process only.

PROPELLER GOVERNOR REMOVAL

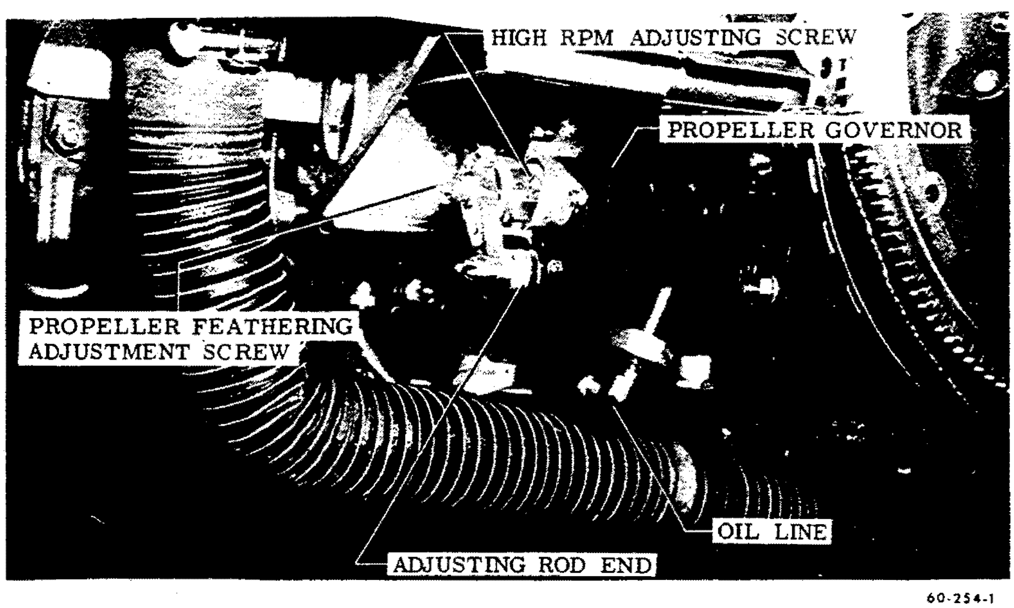
a. Remove cotter pin, nut, washer and bolt attaching the adjusting rod end to the governor.
b. Disconnect the oil line, from the outboard side of the governor.
c. Remove the nuts and washers around the governor base. Remove the governor and cover the engine boss.

PROPELLER GOVERNOR INSTALLATION
(Figure 203)

a. Remove the cover from the engine boss; install a new gasket with the raised portion of the screen facing up.
b. Align the governor spline with the engine drive spline, and install washers and nuts. Diagonally torque the nuts to 150 inch-pounds.
c. Connect the oil line to the outboard side of the governor.
d. Install the bolt, washer, nut and cotter pin attaching the adjusting rod end to the governor.

NOTE

To insure proper adjustment, do not turn the adjusting rod end when installing the governor.



Propeller Governor Installation
Figure 203

PROPELLER GOVERNOR ADJUSTMENT
(Figure 203)

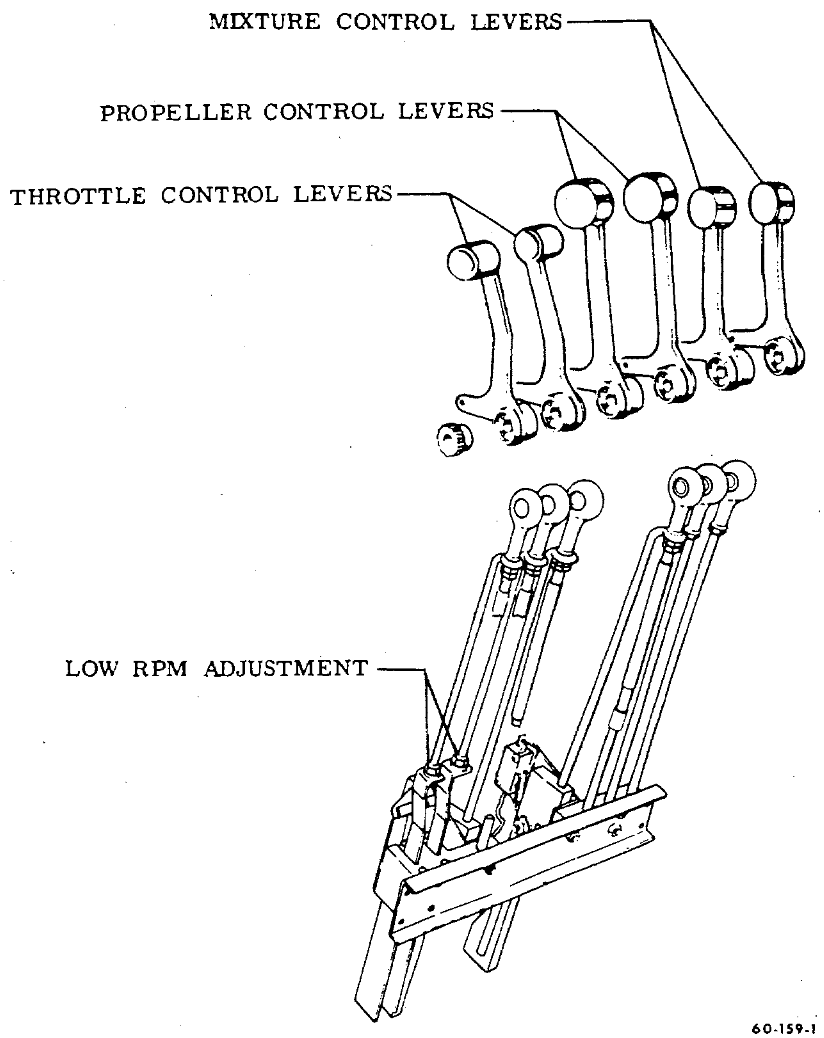
The propeller governor can be adjusted for high and low rpm setting and a feathering adjustment. The high rpm adjustment must be checked while the aircraft is in flight. Observe the take-off rpm to see if it exceeds the redline figure. If excessive rpm is observed, land the plane and adjust the high rpm screw inward to reduce the rpm to the redline figure. The high rpm adjustment screw is located at the rear of the governor just forward of the speed adjusting control lever. One complete revolution of the screw reduces the propeller rpm by approximately 25 to 30 revolutions.

FEATHERING ADJUSTMENT

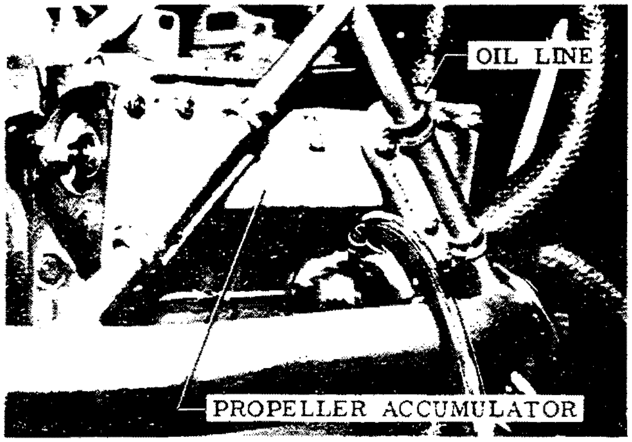
To adjust the feathering action, pull the control back through the detent and observe the point at which the rpm setting begins to fall off sharply, then bring the propeller back to low rpm. The point at which propeller feathering starts should be at 2,100 rpm. If adjustment is required turn the square-head screw on the end of the governor control shaft inward or outward to correct the setting. One half revolution of the screw inward will lower the feathering rpm approximately 100 revolutions. (See Figure 203.)

LOW RPM ADJUSTMENT
(Figure 204)

The low rpm adjustment is made while the airplane is on the ground. To make this adjustment, pull the propeller lever back against the detent. Slowly move the throttle control lever forward until the rpm stabilizes. Observe the rpm setting. If the rpm varies from the specified low rpm setting of 2350 rpm the low rpm setting must be adjusted. The low rpm adjustment is made on the detent rod, which is located behind the instrument panel on the governor control



Propeller Low RPM Adjustment
Figure 204



Unfeathering Accumulator
Figure 205

linkage. To increase the setting, lengthen the rod; to decrease the setting, shorten the rod.

PROPELLER ADJUSTMENT

For high and low pitch adjustments, service, overhaul and maintenance procedures refer to the manufacturers applicable FAA Approved Propeller Manuals.

PROPELLER ACCUMULATOR

The propeller accumulators are located on the lower rear section of each engine. The accumulators should be inspected every 100 hours and charged with dry air or nitrogen to 125 psi.

PROPELLER ACCUMULATOR REMOVAL
(Figure 205)

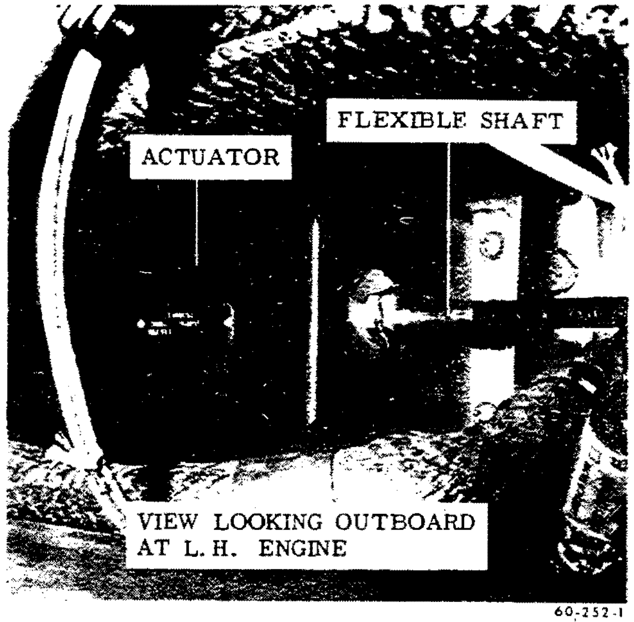
a. Check the propeller control lever for unfeathering (low pitch) position, to release accumulator pressure.

CAUTION

This system has approximately 300 psi of pressure with the propeller in full-feather position.

b. Remove the oil line from the end of the accumulator.

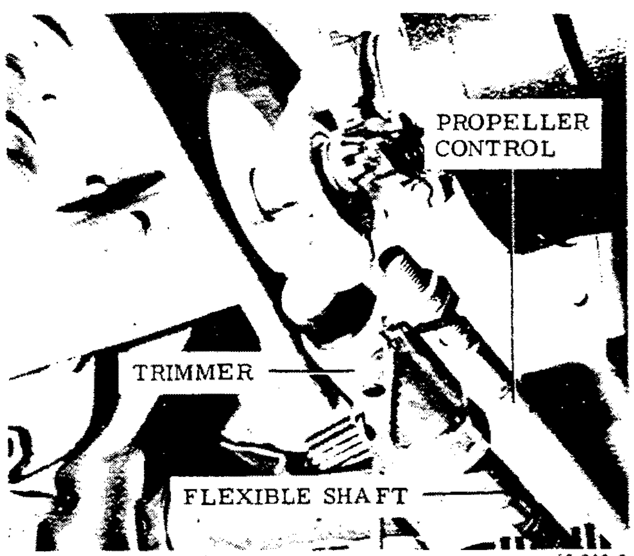
c. Remove the four clamps that hold the accumulator mounting brackets to the engine mount and remove the accumulator.



Propeller Synchronizer Actuator
Figure 206

PROPELLER ACCUMULATOR INSTALLATION

a. Position the accumulator against the engine mount



Propeller Synchronizer Trimmer
Figure 207

and install the four attaching clamps.

b. Connect the oil line to the end of the accumulator.

c. Charge the accumulator with dry compressed air or nitrogen to 125.

SYNCHRONIZER FUNCTIONAL TEST
(Figure 206)

Proper operation of the propeller synchronizer can be determined by the following method. Turn the synchronizer on in the normal manner, then decrease the right propeller rpm in small increments. Both propellers should decrease together until the actuator reaches the end of its travel, then the left propeller should stabilize its rpm while the right continues to decrease. Increase the right propeller rpm until both propellers commence to increase rpm together. Turn the system OFF. An unsynchronized condition will develop as the actuator runs to its midrange position. When the synchronizer is turned ON, the left propeller should again synchronize with the right.

SYNCHRONIZER RIGGING
(Figure 207)

a. Disconnect the flexible trimmer shaft from the actuator.

b. Rotate the shaft in one direction until it reaches the internal stop in the trimmer. Check the propeller control to assure that it has full travel in both directions.

c. Rotate the shaft in the other direction until it reaches the stop, counting the turns. Again check the propeller control for full travel in both directions.

d. Rotate the shaft to the center of its range.

e. Count total turns available in the actuator motor and turn it to the center of its range. The motor can be turned by inserting a square shaft end into the drive.

f. With both the trimmer and the actuator motor centered, connect the flexible shaft.

g. Rig the propeller controls in the normal manner.

SYNCHRONIZER CHECKS

These checks will help locate the source of trouble should the synchronizer system malfunction. If no malfunctions are found among the units being tested, the transistorized control box is probably the source of trouble. An ohmmeter and voltmeter are required to conduct the tests outlined below.

SYNCHRONIZER WIRING CHECK
(Chart 201)

a. To eliminate the most obvious causes for malfunction, make sure that the aircraft master switch is ON, that the system circuit breaker is not tripped, and that the Jones plug receptacle is properly mated with the plug in the aircraft electrical system.

b. Unplug the control box, turn the aircraft master switch OFF, and pull the synchronizer circuit breaker before proceeding further with these checks.

CHART 201
SYNCHRONIZER RESISTANCE CHART

TEST BETWEEN RECEPTACLE NUMBERS:	OBTAIN		
		With actuator uncentered 180°	
	With actuator centered	Turn clockwise (facing drive end) to uncenter	Counterclockwise (facing drive end) to uncenter
5 and 1	Open circuit (high resistance)	6.5 to 8.5 ohms	6.5 to 8.5 ohms
5 and 3	Open circuit (high resistance)	Closed circuit 0 to 1 ohm	13 to 17 ohms
5 and 4	Open circuit (high resistance)	13 to 17 ohms	Closed circuit 0 to 1.0 ohms
4 and 1	6.5 to 8.5 ohms	6.5 to 8.5 ohms	6.5 to 8.5 ohms
4 and 3	13 to 17 ohms	13 to 17 ohms	13 to 17 ohms
3 and 1	6.5 to 8.5 ohms	6.5 to 8.5 ohms	6.5 to 8.5 ohms

c. Complete resistance checks. (See CHART 201.)

CAUTION

Zero the ohmmeter and read on the X1 to X10 scale during the following checks. Do not use a probe greater than .045 inch in thickness. Insert and remove the probe carefully to avoid damaging the pin connectors.

NOTE

Later propeller governors are equipped with an improved type of magnetic pickup. The new type has a solid steel pickup end; while the old type has a visible ceramic core. Any combination of new or old magnetic pickups is acceptable between engines.

d. Complete the following checks.

1. Using an ohmmeter, test that the resistance between pin receptacles 7 and 8 of the Jones cinch socket (see Figure 208) is 52 to 68 ohms (new pickup), or 90 to 110 ohms (old pickup) with pin receptacle 6 disconnected at the pickup.

2. Check that the resistance between pin receptacle 6 and 8 is 52 to 68 ohms (new pickup), 90 to 110 ohms (old pickup) with pin receptacle 7 disconnected at the pickup.

e. Make the following checks with an ohmmeter connected to the pin receptacles of the Jones cinch socket (P/N 233032).

1. Check that an open circuit (very high-resistance) exists between pin receptacle 8 and airplane ground and between pin receptacle 2 and ground.

2. Check that a closed circuit (zero ohms) exists between pin receptacle 1 and ground.

f. Turn the airplane master switch ON and reset the synchronizer circuit breaker, but leave the control box unplugged.

g. Using a DC voltmeter, check that the voltage between pin receptacles 1 and 2 is the same as the supply voltage and that the polarity of pin number 1 is negative while that of pin number 2 is positive.

h. Using a 5000 ohm/volt AC voltmeter and with the engines running-near-cruise rpm, probe pins 6 and 8 for pickup voltage on the left (slave) engines and pins 7 and 8 for pickup voltage on the right (master) engine. These values should be between 1/2 volt minimum and 3 volts maximum.

i. When the system is in compliance with the preceding check values, plug the control box into the synchronizer system. If the synchronizer system still malfunctions, the source of trouble is probably either in the control box itself or is the result of a mechanical failure of the flexible shaft or governor speed trimming device.

j. Check the speed pickups mounted on the governor for oil leaks or looseness.

k. Remove the flexible rotary shaft and rotate the actuator through its range. It should stop positively at each end of its range and should rotate freely except for the ratcheting effect of the detent wheel. The normal output torque is 15 ounce-inches. Make sure the actuator is returned to the center of its range.

Adjust the governor trimmer by turning the squared end of the flex shaft by hand (a turning fixture may be required to turn the shaft in the direction to decrease rpm). Under any circumstances, a turning fixture 1/4 inch in diameter should be adequate for rotating the trimmer freely throughout its range. After thus verifying that the friction between the rotating parts is at an acceptable level, recenter the trimmer and attach it to the actuator.

If the response of the system to the preceding checks has been satisfactory, the airplane is ready for flight.

FLIGHT CHECKS

a. Check the effect of rpm and/or power setting (particularly in the lower cruise range) on synchronizer action. If operation at lower rpm resulted in improved synchronization, inspect the drives to the governors.

b. Reduce the electrical load and turn off the generator and all other electrical units, except the master switch, and synchronizer if synchronizing improves, abnormal voltage spikes on the airplane bus from some other electrical accessory may have been upsetting the synchronizer. Isolate the offending accessory and repair it. If the trouble lies in the control box, replace it.

100-HOUR INSPECTION

PROPELLER - Inspect the propeller for nicks, dents, cracks, evidence of leakage, condition and security.

AIR DOME - Check the propeller air dome for correct pressure.

DEICER BOOTS - Check the boots for hot spots, exposed heating element wires, tears and security to the blades.

SPINNER AND BULKHEAD - Check the spinner and bulkhead for nicks, dents, cracks, condition and security. Check deicer boot wires for security at the starter ring gear.

PROPELLER GOVERNORS - Inspect the governor for oil leakage, condition and security.

CONTROL LEVERS - Check levers for smooth and free movement and cushion. Check controls at the governor for security and full travel against the stops.

ACCUMULATOR - Inspect for oil leakage, condition and security. Check air pressure.

SYNCHRONIZER - Check all components of the system for condition and security. Any discrepancies noted during ground or flight should be isolated using the troubleshooting chart and the wiring check. Consult Woodward Governor Bulletins 33032A and 33049C for further detailed information.

"END"

CHAPTER 71

LIST OF PAGE EFFECTIVITY

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	202	Nov 2/73
	203	Nov 2/73
71-10-00	201	Nov 2/73

CHAPTER 71 - POWER PLANT

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"END"

GENERAL - DESCRIPTION AND OPERATION

The Duke is equipped with Lycoming TIO-541-E1A4 and/or TIO-541-E1C4 engines. They are rated at 380 horsepower at 2900 rpm and 41.5 in. Hg, and are turbochargered for high performance at altitudes to 30,000 feet. The engines power three-bladed, 74 inch diameter, constant speed, full feathering, hydraulically controlled propellers.

"END"

TROUBLESHOOTING
ENGINE

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Failure of engine to start.	a. Lack of fuel.	a. Check fuel system for leaks. Fill fuel cell. Clean dirty lines, strainers or fuel valves.
	b. Overpriming.	b. Unload engine by standard clearing procedure.
	c. Incorrect throttle setting.	c. Open throttle to 1/4 of its range.
	d. Defective spark plugs.	d. Clean and adjust or replace spark plugs.
	e. Defective ignition wire.	e. Check with tester and replace any defective wires.
	f. Improper operation of magneto.	f. Clean points. Check timing.
	g. Internal failure.	g. Check oil screens for metal particles. If found, complete overhaul of engine is indicated.
2. Failure of engine to idle properly.	a. Incorrect idle mixture.	a. Adjust mixture control.
	b. Incorrect idle speed.	b. Adjust idle speed.
	c. Leak in induction system.	c. Tighten all connections, replace any defective parts.
	d. Uneven cylinder compression.	d. Check condition of piston rings and valve seats.
	e. Faulty ignition system.	e. Check ignition system.
3. Low power and uneven running.	a. Mixture too rich, indicated by sluggish engine, red exhaust flame. Extreme cases indicated by black smoke at exhaust.	a. Readjust fuel injector.
	b. Mixture too lean; indicated by overheating and back-firing.	b. Check fuel lines for restrictions. Readjust mixture.
	c. Leak in induction system.	c. Tighten all connections, replace any defective parts.
	d. Defective spark plugs.	d. Clean and gap or replace spark plugs.

TROUBLESHOOTING
ENGINE (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
3. Low power and uneven running.(Cont'd).	e. Improper fuel.	e. Fill cell with fuel of recommended grade.
	f. Magneto breaker points not working properly.	f. Clean points, check timing.
	g. Defective ignition wire.	g. Check wires with tester, replace any defective wires.
	h. Defective spark plug terminal.	h. Check and replace connectors if necessary.
4. Failure of engine to develop full power.	a. Leak in the induction system.	a. Tighten all connections replace any defective parts.
	b. Throttle lever out of adjustment.	b. Check travel of throttle linkage.
	c. Improper fuel flow.	c. Check strainers and flow at fuel injector.
	d. Restriction in air scoop.	d. Examine air scoop and remove any obstruction.
	e. Improper fuel.	e. Drain and refill cell with fuel of recommended grade.
	f. Faulty ignition.	f. Check ignition system.
5. Rough engine.	a. Cracked engine mount.	a. Replace or repair mount.
	b. Defective mounting bushing.	b. Replace bushing.
	c. Uneven compression.	c. Check compression.
6. Low oil pressure.	a. Insufficient oil.	a. Fill sump with oil.
	b. Air lock or dirt in relief valve.	b. Remove and clean oil pressure relief valve.
	c. Dirty oil strainers.	c. Remove and clean oil strainers.
	d. High oil temperatures.	d. See step 7.
	e. Defective pressure gage.	e. Replace gage.
	f. Stoppage in oil pump inlet passage.	f. Check line for obstruction.
7. High oil temperature.	a. Insufficient oil supply.	a. Fill sump with oil of recommended grade.

TROUBLESHOOTING
ENGINE (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
7. High oil temperature.(Cont'd).	b. Low grade of oil.	b. Drain and fill sump with oil conforming to specifications.
	c. Clogged oil lines or strainers.	c. Clean oil lines and strainers.
	d. Excessive blow-by.	d. Usually caused by worn or stuck rings.
	e. Failed or failing bearings.	e. Examine oil strainers for metal particles. If found, overhaul of engine is indicated.
	f. Defective temperature gage.	f. Replace gage.
8. Excessive oil consumption.	a. Low grade of oil.	a. Fill sump with oil conforming to specifications.
	b. Failing or failed bearings.	b. Check sump for metal particles.
	c. Worn piston rings.	c. Install new rings.
	d. Incorrect installation of piston rings.	d. Install new rings.
	e. Failure of rings to seat (nitrided barrels).	e. Use mineral base oil. Climb to cruise altitude at full power and operate at 75% cruise power setting until consumption stabilizes.

"END"

GENERAL - MAINTENANCE PRACTICES

ENGINE REMOVAL

CAUTION

The engine induction air is supplied through a fiberglass duct located in the right hand section of the engine compartment. Care should be taken when removing or installing the engine that no dirt or foreign objects, be allowed to enter the induction system. Be careful not to damage the fiberglass ductwork attached to the firewall.

a. Check the magneto switches for "OFF" position.

WARNING

To be safe, treat all magnetos as hot whenever the ground lead is disconnected. To ground the magneto, disconnect the magneto switch lead wire at the capacitor and ground the capacitor pole. If this is impractical, remove the ignition harness distributor cap, or disconnect the spark plug leads.

b. Remove the upper and lower engine cowling. (Refer to Chapter 71-10-00.)
c. Remove the propeller. (Refer to Chapter 61-10-00.)
d. Disconnect all plumbing at the firewall. Be sure to cap all open lines and fittings.

CAUTION

Place the fuel selector valve handle in the "ON" position to relieve approximately 60 psi of pressure in the fuel line from the firewall to the fuel pump.

e. Disconnect and identify all electrical wiring at the firewall.
f. Disconnect all engine controls.
g. Place a wing stand under the opposite wing and a support under the tail.
h. Position the engine hoist and attach the hoisting sling to the three lifting eyes on the engine.
i. Remove the slack from the hoisting cable and remove the bolts that attach the engine mounts to the firewall.
j. Remove the engine and place in a suitable work stand.

ENGINE BUILD-UP

Engine build-up consists of the removal of accessories and equipment from the old engine and installing them on the new engine. Refer to the Lycoming Engine Overhaul Manual, P/N 60294-6, for proper torque values.

NOTE

Tag or identify all hoses, bolts, washers, nuts, electrical connectors, and note harness clamp locations for reinstallation on the new engine. Cap all open hoses and engine ports to prevent contamination.

NOTE

Torque engine mount (isolators) bolts to 250-300 inch-pounds.

ENGINE INSTALLATION

a. Observe the WARNING and CAUTION notes in ENGINE REMOVAL.
b. Position the engine hoist and attach the hoisting sling to the three lifting eyes on the engine.
c. Move the hoist into position in front of the firewall, align the bolt holes of the engine mount and those of the firewall. Install the engine mount bolts and torque to 350 - 390 inch-pounds.

NOTE

If the engine mount bolt nuts are replaced, use a magnet to ensure they are steel.

f. Disconnect the hoisting sling and move the hoist clear of the aircraft.
g. Connect all electrical wiring at the firewall.
h. Connect all plumbing at the firewall, and all ducting.
i. Connect and adjust all engine controls. (Refer to Chapter 61-00-00.)
j. Install the propeller. (Refer to Chapter 61-00-00.)
k. Install the upper and lower engine cowling. (Refer to Chapter 71-10-00.)
l. Perform an engine run-up and complete final adjustments.

NOTE

If a new or newly overhauled engine has been installed, the engine fuel and oil system must be depreserved and serviced. (Refer to Chapter 12-10-00 for Servicing.)

GROUND RUNNING AND WARM-UP

Because the turbocharged engines depend on forward air speed for cooling, caution should be used to prevent overheating on the ground. The following precautions should be followed when performing power checks or engine run up:

a. Head the aircraft directly into the wind.
b. Operate the engines on the ground with the propeller in the low pitch position (unfeathered position).
c. Maintain the cylinder head temperature between 150°C and 246°C. Never allow the cylinder head temperature to exceed 246°C.
d. The turbine inlet temperature (TIT) gage, must not exceed 900°C.
e. Extended periods of idling at low rpm may result in fouled spark plugs.
f. The mixture control should remain in the "FULL RICH" position unless leaning is required during the checkout.
g. Warm up the engine at 1000 to 1500 rpm.

NOTE

The oil pressure should be within the red radial in 30 seconds; normal oil pressure should be approximately 90 psi at maximum rpm.

The oil seals incorporated in the turbocharger derive their sealing capabilities from oil pressure. At low engine idle speeds, the seals will allow some oil seepage onto the turbocharger shaft, which will cause coking (oil and carbon deposit buildup). Therefore, during taxiing, engine runup or ground test, it is advisable to maintain idling speeds of approximately 1200 rpm until the turbocharger temperature has stabilized. This engine speed will exert enough oil pressure against the shaft seals to prevent oil seepage. When the turbocharger temperature has stabilized, the engine may be shut down with a minimum of coking.

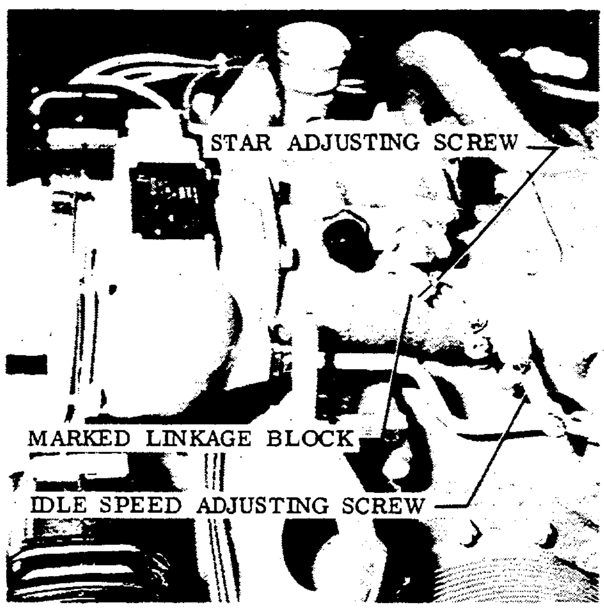
IDLE SPEED AND MIXTURE ADJUSTMENT

(Figure 201)

a. Start the engine and run at 1000 to 1500 rpm until the oil and cylinder head temperature gages read normal.
b. Check magneto drop-off. (See MAGNETO DROP-OFF CHECK, Chapter 74-10-00.) Maximum drop-off should not exceed 175 rpm. If the magneto drop-off is within limitations, proceed with the idle adjustment.
c. Slowly retard the throttle lever to the idle position. The engine tachometer should indicate 700 rpm (normal idle setting). To adjust, turn the idle speed adjusting screw at the throttle lever stop until the desired rpm is reached.
d. When the idle speed has stabilized, move the mixture control lever with a smooth, steady pull into the "IDLE CUT-OFF" position. Observe the tachometer for any change during the leaning out process.

CAUTION

Return the mixture control to the FULL RICH position before the rpm can drop to a point where the engine cuts out.



Idle and Mixture Adjustment
Figure 201

An increase in rpm while leaning out indicates the idle mixture is on the rich side of best power. An immediate decrease in rpm (if not preceded by a momentary increase) indicates that the idle mixture is on the lean side of best power. The desired idle setting is a compromise between one that is rich enough to provide a satisfactory acceleration under all conditions and lean enough to prevent spark plug fouling or rough operation. A rise of 25-50 rpm, during the leaning process, will usually satisfy both of these conditions.

e. Adjustment of the mixture is accomplished by turning the "STAR" adjustment screw, one or two notches, in the direction required, as noted on the linkage blocks with an R for Rich, and an arrow for direction of rotation.

NOTE

For major adjustments refer to Bendix Manual Form 15-468.

f. After each idle mixture adjustment change, clear the engine by running it up to 2000 rpm before making a mixture check.

g. Recheck the idle speed as stated in step "c". Make final idle speed adjustment, if necessary.

NOTE

If the idle setting does not remain stable, check the idle linkage; any looseness on this linkage will cause erratic idling. In all cases, allowances should be made for the effect of weather conditions upon idling adjustments.

THROTTLE–LANDING GEAR WARNING HORN SWITCH ADJUSTMENT

a. In flight, place the propeller lever in low pitch. Slowly pull both throttle levers back until 12 to 14 in. Hg manifold pressure is indicated. Mark this position on the quadrant.

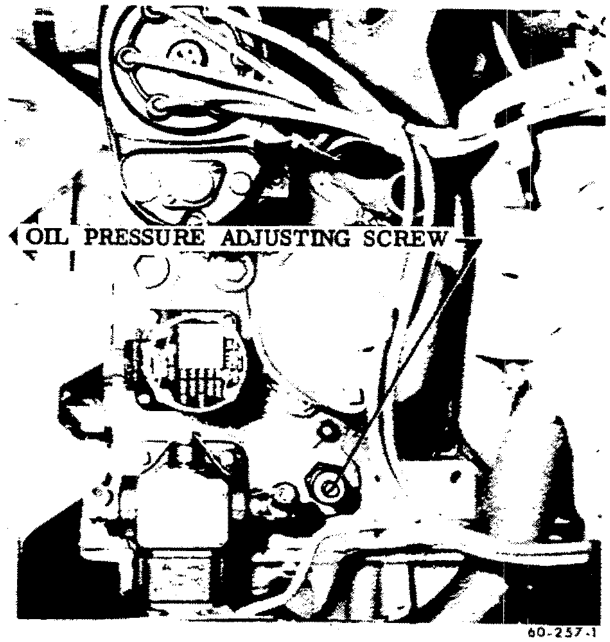
b. Land the airplane and shut the engine down.

NOTE

The landing gear warning horn micro-switches are located on a bracket, at the lower end of the throttle linkage, in the console.

c. Position the throttle levers on the mark previously made. Raise or lower the micro-switches until the cams "click" the switches closed. Secure the switches in this position.

d. Fly the airplane to check adjustment.



Oil Pressure Adjustment
Figure 202

OIL PRESSURE ADJUSTMENT
(Figure 202)

The oil pressure adjustment screw is located approximately 3 inches directly below the oil filter housing. To adjust, turn the adjusting screw clockwise to increase or counterclockwise to decrease oil pressure. Run the engine at 2600 rpm with normal operating oil temperature and set the oil pressure at 80 psi.

"END"

COWLING - MAINTENANCE PRACTICES

COWLING REMOVAL

a. Check the magneto switches for OFF position.

b. Disconnect the cowl flap actuator from the cowl flap.

c. Open both cowl doors, remove the two screws on each side of the nose bug.

d. Support the lower cowl and remove either the upper or lower two screws in each cowl fairing channels aft of the propeller spinner.

e. Remove the screws across the aft end of the upper and lower cowls and remove cowls from the engine.

COWLING INSTALLATION

a. Check the magneto switches for OFF position.

b. Position the upper cowl over the engine and install screws across the aft end.

c. Support the lower cowl against the engine and install the screws across the aft end.

d. Install the four screws on each side of the nose bug and in each cowl fairing aft of the propeller spinner.

e. Connect the cowl flap actuator to the cowl flap. Check cowl flap actuator rigging.

COWL FLAP AND ACTUATOR REMOVAL

a. With the cowl flap open, disconnect the cowl flap actuator rod end from the cowl flap clip.

b. Remove the bolts from the cowl flap hinges and remove the cowl flap.

c. Remove the AMP terminals from the cowl flap actuator leads.

d. Remove the bolt holding the cowl flap actuator to the actuator support arm and remove the actuator.

COWL FLAP AND ACTUATOR INSTALLATION

a. Install the bolt attaching the upper end of the actuator to the nacelle structure.

b. Connect the AMP terminals to the actuator leads.

c. Align the cowl flap hinges and install the attaching bolts.

d. Connect the actuator rod end to the cowl flap clip. Check actuator rigging.

RIGGING THE COWL FLAP ACTUATOR

a. Set the actuator to 11.43 inches open (extended).

b. Install the actuator on the actuator support arm and attach the rod end to the cowl flap clip.

c. Adjust the actuator so that the cowl flap sides will extend into the cowl by .25 inches minimum when open. If the cowl flap does not meet the minimum required extension into the cowl, adjust the actuator to obtain this position. A minimum of .06 inch clearance is required between the actuator lug and actuator support, and between the actuator rod end lug and the cowl flap clip through the entire range of movement. Install a new cotter pin.

"END"

CHAPTER 72

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CHAPTER 72 - ENGINE

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NOTE

Refer to the Lycoming Engine Overhaul Manual, P/N 60294-6, for detailed information on the above subjects.

"END"

CHAPTER 73

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73-30-00	201	Oct 19/77

CHAPTER 73 - ENGINE FUEL AND CONTROL

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"END"

FUEL FLOW INDICATING - MAINTENANCE PRACTICES

FUEL FLOW INDICATOR

The fuel flow indicator is an aid to the pilot when leaning the engines during flight. The major components of the system are the transducer or transmitter and the indicator. The transducer or transmitter is located in the fuel line of each engine forward of the firewall. This device generates a signal that is directed to the fuel flow indicator. The fuel flow indicator gives a readout in pounds of fuel per hour. The indicator has dual pointers, one for each engine and is located in the top center of the instrument panel. The circuit breaker is located in the upper copilots side panel.

Early airplanes (prior to P-465 except P-427, P-428, P-429, P-431, P-432, P-433) have a system which operates on 26 volts ac, 400 cycles. On these airplanes there is an inverter located near fuselage station 119.28 and to the rear of the firewall of the left engine. On these early airplanes there is a fuel flow fuse in the lower pilots side panel.

On airplane serials P-427 through P-429, P-431 throu P-433 and P-466 and after the system operates on 28 vo dc, airplane bus voltage.

TRANSDUCER OR TRANSMITTER REMOVAL

a. Open the right engine cowl.
b. Disconnect the electrical connection.
c. Disconnect the two fuel lines, and cover the open ing to prevent contamination.
d. Remove the bolts holding the transducer or tran mitter in place, and remove the unit.

TRANSDUCER OR TRANSMITTER INSTALLATION

a. Install the transducer or transmitter with the attac ing bolts. Safety wire the bolts.
b. Connect the two fuel lines.
c. Connect the electrical connection.
d. Close the engine cowl.

"END"

CHAPTER 74

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74-10-00	201	Nov 2/73
74-20-00	201	Nov 2/73

CHAPTER 74 - IGNITION

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"END"

GENERAL - DESCRIPTION AND OPERATION

Each engine is equipped with two Bendix S-1200 series magnetos. The left magneto incorporates a retard breaker point assembly which provides a fixed retard and long duration spark for easier starting. The right magneto has only the conventional breaker points which are grounded out when the engine is being started.

"END"

ELECTRICAL POWER SUPPLY - MAINTENANCE PRACTICES

MAGNETO DROP-OFF CHECK

T he magneto drop-off may be checked as follows:

a. Throughly warm up engine and set the propeller control in low pitch. Place the mixture control in "FULL RICH".

b. Set the throttle to produce 2000 rpm.

c. Note the amount of rpm drop-off as the magneto switch is turned from "BOTH" to "LEFT" and back to "BOTH", and then to "RIGHT" position.

CAUTION

Operation on one magneto should not exceed 5 seconds to avoid fouling the spark plugs.

d. Normal magneto drop-off is approximately 100 rpm on either magneto and should be within 50 rpm of each other. If the magneto drop-off persistently exceeds 175 rpm, an inspection to determine the cause should be accomplished. Common causes are incorrect grade of fuel, fouled or incorrectly gapped spark plugs, incorrectly timed magnetos, incorrect air/fuel ratio.

MAGNETO BREAKER POINT ADJUSTMENT

Every 100 hours check the breaker points for condition, clearance and timing. Breaker point clearances for the magnetos are .016 ± .006 for the retard points and .016 ± .003 for the conventional points. If the points are burned or worn excessively, do not try to redress the contact surfaces. Install a complete new breaker assembly if the points are found to be in an unsatisfactory condition. Wipe the breaker compartment free of any oil or dirt with a clean cloth.

MAGNETO TIMING
(Figure 201)

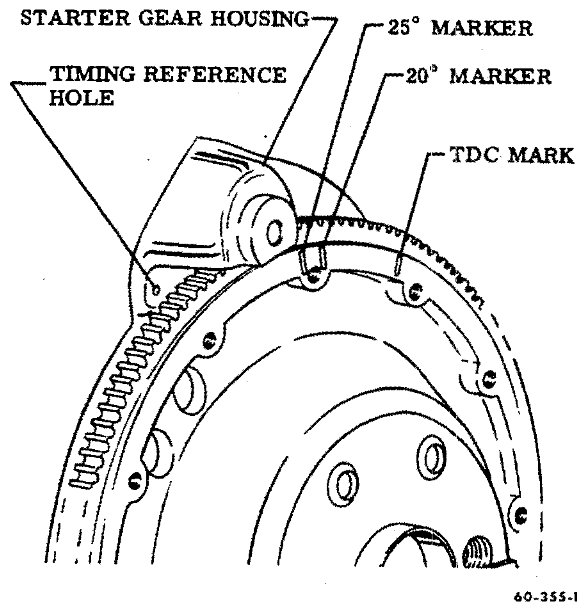
a. Remove a spark plug from No. 1 cylinder and turn the crankshaft in the direction of normal rotation until the compression stroke is reached.

b. Continue turning the crankshaft until the 20° BTC advance timing mark, on the forward face of the starter ring gear, is in alignment with the small hole located on the face of the starter housing.

c. Remove the inspection plug on the left magneto and turn the drive coupling in the direction of normal rotation until the first marked tooth is aligned in the center of the inspection hole. Without allowing the gear to turn from this position, assemble the gasket and magneto to the engine.

d. Using an electric timing light, fasten the ground wire to any unpainted portion of the engine and one of the positive wires to a suitable terminal connected to the ground terminal of the magneto. Then turn the crankshaft several degrees from the advance timing mark in the direction opposite to that of normal rotation.

e. With the timing light on, turn the crankshaft slowly in the direction of normal rotation until the mark on the starter ring gear aligns with the hole in the starter housing. If the timing is correct the timing light should go out.



Magneto Timing Reference Points
Figure 201

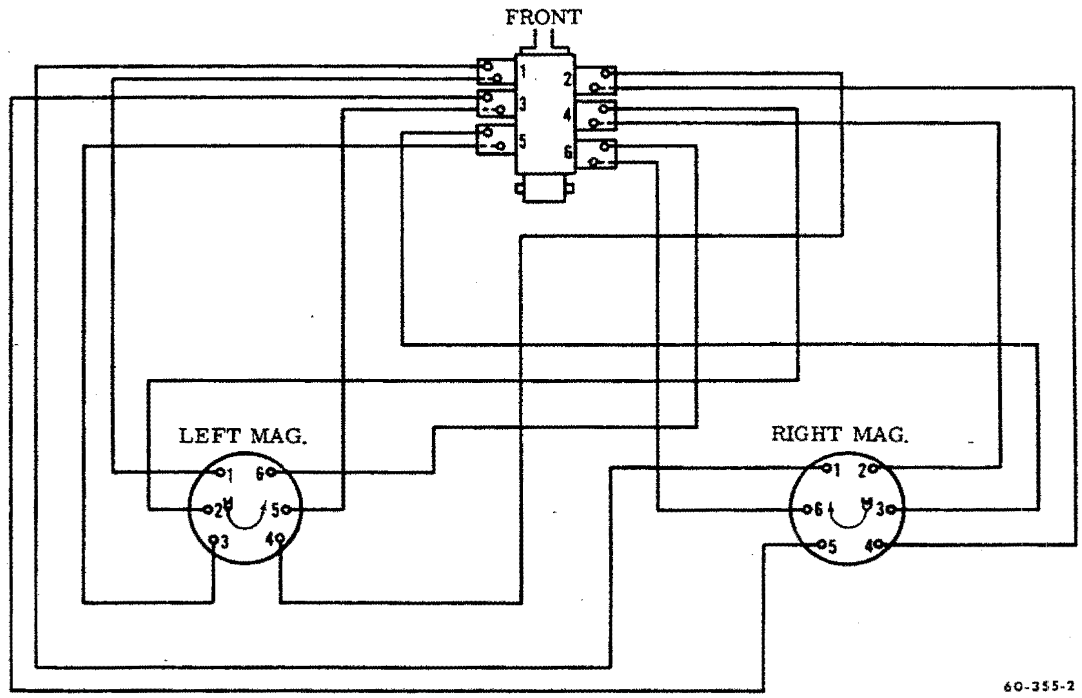
NOTE

When a battery powered timing light is used, the light will go on when the marks align.

"END"

DISTRIBUTION - MAINTENENCE PRACTICES
(Figure 201)

In the event that an ignition harness or an individual lead is to be replaced, consult the Magneto Wire Routing Diagram, Figure 201, to be sure that the harness is correctly installed. Mark locations of clamps and clips to be certain that the replacement is clamped at the correct locations.



FIRING ORDER: 1-4-5-2-3-6

Magneto Wire Routing Diagram
Figure 201

"END"

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"END"

GENERAL - MAINTENANCE PRACTICES

TIT INDICATOR CALIBRATION
(Figure 201)

CAUTION

Damage to the turbocharger turbine blades, excessive turbine coking and excessive oil consumption may be caused by turbine inlet temperatures above 900°C (1650°F).

To prevent a turbine inlet over-temperature condition due to an inaccurate TIT indicator reading, the indicator should be checked every 100 hours and calibrated if required.

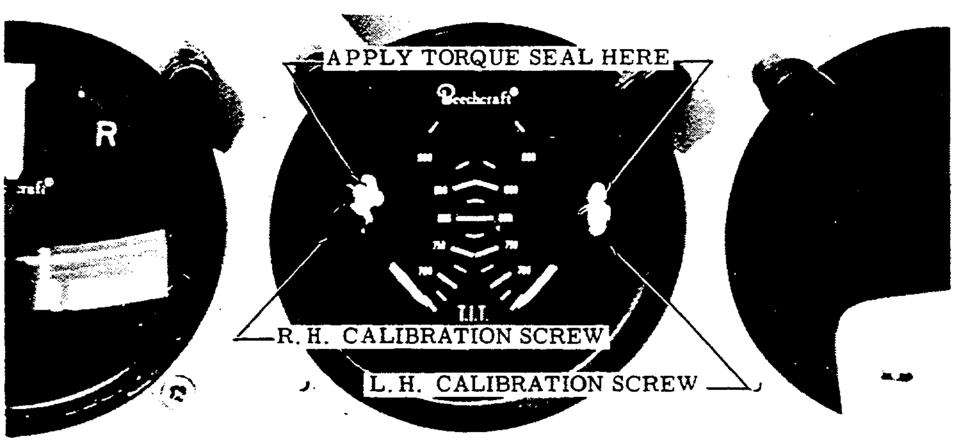
The following procedure may be used to check and calibrate the TIT indicator.

a. Remove the TIT probe from the turbocharger intake manifold on the RH engine. (Do not disconnect the wires from the probe.)
b. Using the AlCal test equipment, heat the probe to 900°C.
c. If the TIT indicator reads 900°C, the indicator is properly calibrated. If the reading is not 900°C, the calibration screw on the face of the instrument should be adjusted to obtain this reading.
d. If the seal was broken on the calibration screw, reseal by applying a small amount of torque seal as shown in Figure 201.
e. Reinstall the probe in the turbocharger intake manifold.
f. Repeat the above procedure on the LH engine.

ALCAL CALIBRATION UNIT

The AlCal Calibration unit, available locally through the Beechcraft Parts and Service Outlets, provides a simple and accurate method for checking and, if necessary, recalibrating aircraft piston engine EGT systems. If the red line temperature is exceeded by the TIT indicators, the calibration unit will quickly determine if the fault lies with the indication system or the engine. The following method will accomplish the TIT calibration test:

a. Light the AlCal unit and support it from the engine cowling.
b. Place the TIT thermocouple into the comparator port of the AlCal unit until it is touching the reference thermocouple.
c. Raise the heat of the AlCal unit until the temperature of 1650°F (900°C) is indicated on the unit's reference meter.
d. Because both thermocouples are measuring the same temperature, the aircraft-installed TIT indicator should indicate the same red line temperature. If the indicator corresponding to the engine being tested does not register 1650°F (900°C), refer to the adjustment procedure outlined under TIT INDICATOR CALIBRATION in this chapter.
e. Replace the TIT thermocouple in the turbocharger intake manifold. Lubricate the threads on the probe with MIL-A-907D anti-seize compound (Chart 208, 91-00-00).



TIT Indicator Calibration
Figure 201

"END"

CHAPTER 79

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CHAPTER 79 - OIL

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"END"

GENERAL - DESCRIPTION AND OPERATION

The engines are equipped with a wet sump, pressure type oil system with a capacity of 13 quarts. The sump fastens to the bottom of the crankcase and incorporates two oil drain plugs and the oil suction screen housing. A pressure relief valve installed on P-227and after protects the oil radiator, on these serials, from damage caused by cold weather pressure surges. The oil system may be checked through the access doors in the engine cowling. A calibrated dip stick attached to the filler cap indicates the oil level. Due to the canted position of the engines, the dip sticks are calibrated for either the right or left engine and are not interchangeable.

"END"

GENERAL - MAINTENANCE PRACTICES

The oil should be changes every 75 to 100 hours under normal operating conditions and the oil filter changed every 50 hours.

All TIO-541 series engines are limited to using only ashless dispersant multi-grade oil conforming to MIL-L-22851 (see Chart 201) or a Lycoming approved synthetic oil. Oil equivalent to SAE 50 or SAE 60 above 60°F; below 30°F SAE 40 is recommmended. However, newly overhauled engines of this series may be run-in on the test stand with single viscosity, grade SAE 50 oil conforming with MIL-L-6082, (6, Chart 207, 91-00-00).

The determining factor for choosing the correct grade of oil is the oil inlet temperature observed during flight; however, inlet temperatures consistently near the maximum allowable indicate a heavier oil is needed. Lycoming recommends use of the lightest weight oil that will give adequate cooling.

CHANGING THE OIL FILTER

The oil filter should be replaced every 50 hours. Replace the filter as follows:

a. Disconnect the fuel line to the inlet side of the engine-driven fuel pump. Cap the fuel line (P-4 through P-20) and push the line down to allow clearance for oil filter removal.

b. Cut the safety wire and remove the filter housing.

c. After making sure all traces of gasket material and cement are removed from the oil filter adapter recess, install the new aluminum ring and O-ring seal which replace the existing rubber gasket. (Refer to Lycoming Service Bulletin No. 337.)

d. Torque the retainer bolt to 25 to 30 foot-pounds and safety.

e. Remove cap (P-4 through P-20) and reinstall the fuel line.

CHART 201
APPROVED ENGINE OILS (ASHLESS DISPERSANT)

SPECIFICATION	*PRODUCT*	**VENDOR*
MIL-L-22851	Global Concentrate A	Delta Petroleum Company Inc. P. O. Box 10397 New Orleans, La. 70121
	Paranox 160 and 165	Enjay Chemical Company 60 West 49th Street New York, N. Y. 10020
	RT-451, RM-173E, RM-180E	Mobil Oil Corporation 150 East 42nd Street New York, N. Y. 10017
	Shell Concentrate A Code 60068 Aeroshell W120 Aeroshell W80	Shell Oil Company One Shell Plaza Houston, Texas 77002
	TX-6309 Aircraft Engine Oil Premium AD120 Aircraft Engine Oil Premium AD80	Texaco Inc. 135 East 42nd Street New York, N. Y. 10017
	PQ Aviation Lubricant 753	American Oil and Supply Co. 238 Wilson Avenue Newark, N. J. 07105

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	201	Nov 2/73

CHAPTER 80 - STARTING

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"END"

GENERAL - DESCRIPTION AND OPERATION

Duke series aircraft are equipped with a 24-volt starter which engages with the accessory drive gear. The starter is located on the top forward end of each engine.

When the ignition switch is placed in the START positior current is supplied by the battery bus which energizes th applicable starter relay providing current to the starter.

"END"

TROUBLESHOOTING
STARTER SYSTEM

TROUBLE	PROBABLE CAUSE	REMARKS
1. Both starters inoperative.	a. Circuit breaker tripped in starter switch circuit.	a. Check for short circuit; reset.
	b. Battery relay inoperative.	b. Check continuity of battery system.
	c. Low battery.	c. Test battery. If low, replace or start with external power.
	d. Loose connections or open circuit between battery relay and left starter relay.	d. Check connections and continuity.
2. One starter inoperative.	a. Starter relay inoperative.	a. Check relay terminal connections and continuity of solenoid energizing circuit. If energizing circuit is closed and relay does not operate, replace relay.
	b. Poor ground at starter.	b. Test continuity from armature lead to ground. Repair if necessary.
	c. Open circuit.	c. Check continuity to starter.
	d. Defective starting motor.	d. Check brushes, springs, condition of commutator; replace if necessary.

"END"

CRANKING - MAINTENANCE PRACTICES

STARTER LUBRICATION

No lubrication is required on the starting motor except at overhaul.

STARTER REMOVAL

a. Open engine cowling.
b. Disconnect and tape starter lead.
c. Remove starter mounting nuts.
d. Lift starter up and aft to remove.

STARTER INSTALLATION

a. Place starter into position and install mounting nuts and cap screws. Tighten securely.
b. Connect starter lead.
c. Fasten engine cowling.

STARTER CIRCUIT CHECKS

a. The starter circuit wiring should be inspected at regular intervals to determine that all connections are clean and tight and that the insulation is sound.

b. The starter circuit should be checked to determine if there is excessive resistance in the circuit. This test is made with a low reading voltmeter while cranking the engine.

1. The voltage loss from the battery positive terminal to the starter terminal should not exceed 0.3 volts.
2. The voltage loss from the battery ground terminal to the starter frame should not exceed 0.1 volt.

If there are greater voltage losses than indicated above, additional checks should be made to locate the high resistance connections.

STARTER BRUSHES

The starter brushes should slide freely in their holders and make full contact on the commutator. The brushes should be replaced when they have worn to one half their original length (approximately 1/4 inch). Proper brush spring tension with new brushes installed is 32 to 40 ounces. This tension is measured with a scale hooked under the brush spring near the brush and the reading taken just as the spring leaves the brush.

"END"

CHAPTER 81

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CHAPTER 81 - TURBINES

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"END"

GENERAL - DESCRIPTION AND OPERATION

TURBOCHARGER SYSTEM
(Figure 1)

The turbocharger is standard equipment on the Duke. It increases the power output and efficiency of the engine by supplying compressed air to the intake manifold. In operation, engine exhaust gas passing over the turbine wheel causes the turbocharger compressor, mounted on the same shaft, to rotate. Ambient, ram air, supplied through the RH cowl door, is filtered and routed to the compressor where it is compressed and delivered to the engine and through a sonic nozzle to the cabin. The sonic nozzle, located on the intake housing, between the turbocharger compressor and throttle valve, supplies air flow for cabin pressurization. As the engine power increases, the flow of exhaust also increases, resulting in a proportionate increase in the speed of the rotating assembly and turbocharger output.

CONTROL SYSTEM

The turbocharger control system is automatic and functions continuously as engine power, speed and altitude are varied. The variable pressure controller, wastegate, wastegate actuator and engine oil are the principal components of the control system. The pressure controller senses compressor outlet pressure and regulates the oil pressure controlling the wastegate actuator position. The wastegate actuator is a hydraulic cylinder with spring tension holding the wastegate butterfly valve open. When oil pressure increases in the actuator, the spring tension is overcome and the butterfly valve closes, routing all exhaust through the turbocharger turbine. The variable pressure controller regulates the oil pressure in the actuator by means of an aneroid bellows which is sensitive to pressure changes at the induction manifold. The metering valve, which is connected to the bellows within the controller, is held closed by spring tension and vacuum. As the induction manifold pressure increases, the force of the aneroid bellows causes the metering valve to open. The controller is regulated by a cam which is connected to the throttle valve. Through this linkage, the pressure setting of the controller is varied proportionally to the amount of power the pilot selects with the throttle. The control system prevents the engine from exceeding 41.5 in. Hg manifold pressure; however, rapid movement of the throttle with low oil temperature or operation at low rpm with high manifold pressure may result in an overboost condition. An overboost condition may cause turbocharger surge, detonation or detuning of the engine counterweight system; any of which may cause serious engine damage.

OVERBOOST CONTROL

On serials P-247 and after, the engine incorporates a relief valve in the induction system which is set to relieve at approximately 44 in. Hg. (See Figure 1.) This valve will open only in the event of a malfunction in the variable absolute pressure controller system.

CAUTION

> To avoid exceeding the normal limits, particularly in cold weather, the last 1-1/2 inches of throttle travel should be applied slowly while observing the manifold pressure. Momentary overboost to the limits of the relief valve (44 in. Hg) will have no detrimental effect on the engine, but is indicative of a malfunctioning variable absolute pressure controller. If overboost is more than momentary, or occurs when engine oil temperatures are normal, the controller should be checked by a authorized facility.

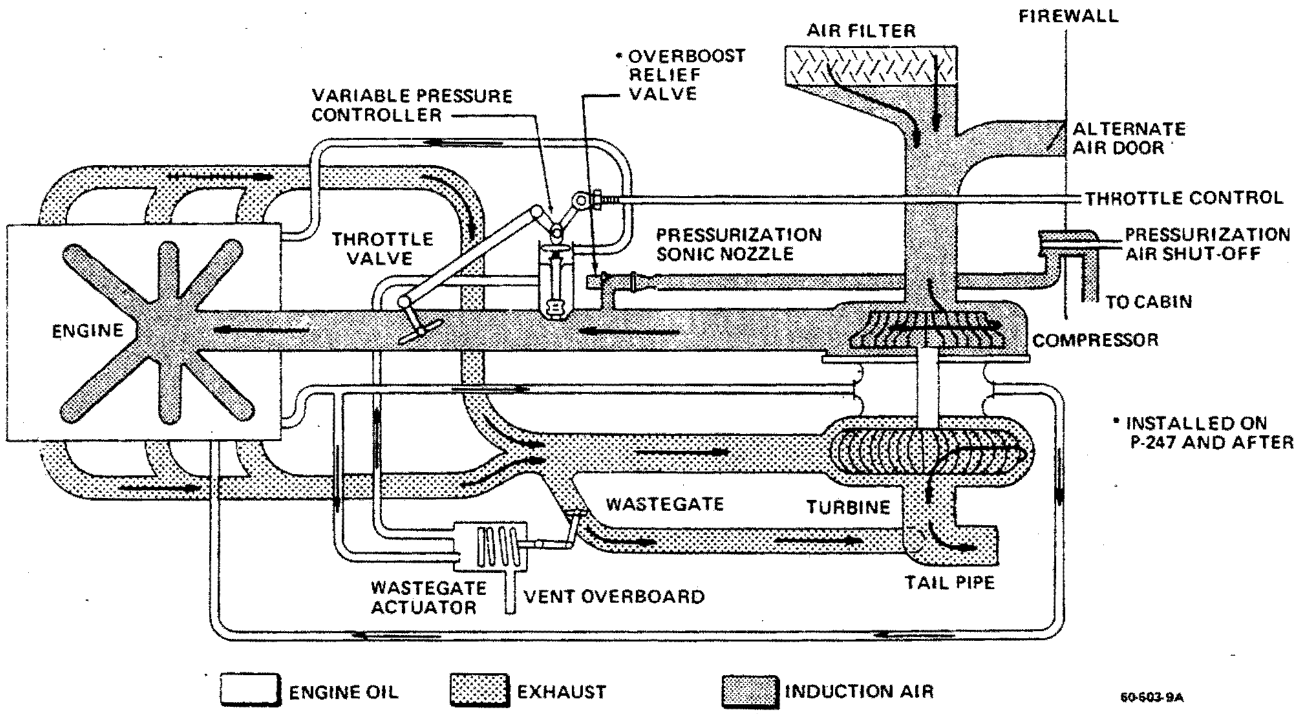
ENGINE AIR INDUCTION SYSTEM

Engine induction air is available as two sources, primary and alternate air. The primary air source is supplied through an intake duct, located on the engine RH cowl door, passes through an air filter, and then into the turbocharger.

NOTE

> The air filter, located in the air box assembly, has a service life of 500 hours with periodic cleaning.

When the primary source of air is obstructed, the turbocharger forms a suction that opens the "Alternate Air Source" door and permits the required volume of air flow for normal engine performance. The alternate air door is located on the firewall behind the induction air box assembly.



Turbocharger System
Figure 1

"END"

TROUBLESHOOTING TURBOCHARGER

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
1. Excessive noise or vibration.	a. Improper bearing lubrication.	a. Supply required oil pressure. Clean or replace oil line. If trouble continues, remove turbocharger and return to approved overhaul station for overhaul or repair.
	b. Leak in engine intake or exhaust manifold.	b. Tighten loose connections, or replace manifold gaskets as necessary.
2. Engine will not deliver rated power.	a. Clogged manifold system.	a. Clean all ducting.
	b. Foreign material lodged in compressor impeller or turbine.	b. Remove turbocharger and return to approved overhaul station for overhaul or repair.
	c. Excessive dirt buildup in compressor.	c. Service engine induction air filter and check for leakage. Remove turbocharger and return to approved overhaul station for overhaul or repair.
	d. Leak in engine intake or exhaust manifold.	d. Tighten loose connections, or replace manifold gaskets as necessary.
	e. Rotating assembly bearing seizure.	e. Remove turbocharger and return to approved overhaul station for overhaul or repair.
	f. Restriction in return lines from actuator to wastegate controller.	f. Remove and clean lines.
	g. Wastegate controller out of adjustment.	g. Have wastegate controller adjusted.
	h. Oil pressure too low.	h. Tighten fittings, replace lines or hoses. Increase oil pressure.
	i. Inlet orifice to actuator clogged.	i. Remove inlet line at actuator and clean orifice.
	j. Wastegate controller malfunction.	j. Replace unit.
	k. Wastegate butterfly not closing.	k. Low pressure, butterfly shaft binding.

TROUBLESHOOTING
TURBOCHARGER (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
2. Engine will not deliver rated power (Cont'd).	l. Impeller binding, frozen or fouling housing.	l. Remove turbocharger and return to approved overhaul station for overhaul or repair.
	m. Piston seal in actuator leaking.	m. Replace actuator or disassemble and replace packing.
3. Critical altitude lower than specified.	a. Controller not getting enough oil pressure to close by-pass valve.	a. Check pump outlet pressure, oil filters and lines for leaks or obstructions.
	b. Chips under metering valve in controller holding it open.	b. Replace controller.
	c. Metering jet in actuator plugged.	c. Remove actuator and clean jet.
	d. Actuator piston seal leaking excessively.	d. Clean cylinder and replace piston seal.
	e. Wastegate valve sticking.	e. Clean and free action.
4. Engine surges or smokes.	a. Air in oil lines or actuator.	a. Bleed system.
	b. Control metering valve stem seal leaking oil into manifold.	b. Replace controller.
	c. Actuator to by-pass valve linkage binding.	c. Correct cause of binding.
	d. Clogged breather.	d. Check breather for restriction to air flow.

NOTE

Smoke would be normal if engine has idled for a prolonged period.

5. High deck pressure (Compressor discharge pressure).	a. Controller metering valve not opening.	a. Replace controller.
	b. Exhaust by-pass valve sticking closed.	b. Shut-off valve in return line inoperative.
	c. Controller return line restricted.	c. Clean or replace line.
	d. Oil pressure too high.	d. Reduce oil pressure.

TROUBLESHOOTING
TURBOCHARGER (Cont'd)

TROUBLE	*PROBABLE CAUSE*	*REMARKS*
5. High deck pressure (Compressor discharge pressure) (Cont'd).	e. Wastegate actuator piston locked in closed position.	e. Disassemble actuator, check condition of piston and packing.
	f. Wastegate controller malfunction.	f. Replace controller.

"END"

GENERAL - MAINTENANCE PRACTICES

INSTALLATION AND INITIAL RUN-IN OF TURBOCHARGER

Immediately prior to mounting the unit, prime the turbocharger lubrication system by inverting the turbocharger and filling the center housing with new, clean oil through the oil drain. Rotate the assembly by hand to coat the bearings and the thrust washer with oil.

Coat the threads of the attaching bolts or studs with high temperature thread lubricant. Connect the ducts and make sure all connections are air tight.

Flush oil through the oil supply line to assure the line is clean and unobstructed. Connect the oil supply line at the engine. To be sure that oil is being supplied to the turbocharger, hold the compressor impeller by hand and start the engine.

WARNING

Do not attempt to stop impeller after unit is rotating.

As soon as oil appears at the end of the oil inlet line, attach the line to the turbocharger and allow the rotating assembly to spin.

Operate the engine at a load and listen for sounds of metallic contact from the turbocharger. If any such noise is apparent, shut down immediately and replace the unit.

For a list of approved turbocharger overhaul and repair facilities, refer to the Component Maintenance Manual P/N 60-590001-27.

RIGGING THE THROTTLE AND TURBOCHARGER PRESSURE CONTROLLER LINKAGE
(Figure 201)

a. With the injector connecting rod installed, determine that the throttle lever moves freely from idle to full open throttle.

b. Adjust the pressure controller rod so that, with the pressure controller cam arm against the full boost stop (full forward position), the throttle lever is approximately .020 - .030 inch from the full throttle position.

VARIABLE PRESSURE CONTROLLER ADJUSTMENT
(Figure 202)

The variable pressure controller is mounted directly to the turbocharger discharge ducting between the oil filler neck and the engine throttle valve.

Adjustment of the controller is made as follows:

a. Head the aircraft into the wind. Set the brakes and chock the wheels.

b. Warm up the engine until the oil temperature reaches a minimum of 185°F.

c. Set the propeller control lever in the high RPM position. Slowly and smoothly apply the throttle until 41 in. Hg manifold pressure or the full throttle position is reached.

CAUTION

Do not exceed 41.5 in. Hg manifold pressure.

d. If at the full throttle position the manifold pressure has not reached 41 in. Hg:

1. Slowly and smoothly shut down the engine.
2. Loosen the locknut on the adjusting screw.
3. Turn the adjusting screw counterclockwise to increase the manifold pressure. (One full turn equals approximately 1 in. Hg manifold pressure).
4. Retighten the locknut on the adjusting screw.

e. If the manifold pressure reaches 41 in. Hg before obtaining full throttle:

1. Slowly and smoothly shut down the engine.
2. Loosen the locknut on the adjusting screw.
3. Turn the adjusting screw clockwise to decrease the manifold pressure. (One full turn equals approximately 1 in. Hg manifold pressure).
4. Retighten the locknut on the adjusting screw.

CAUTION

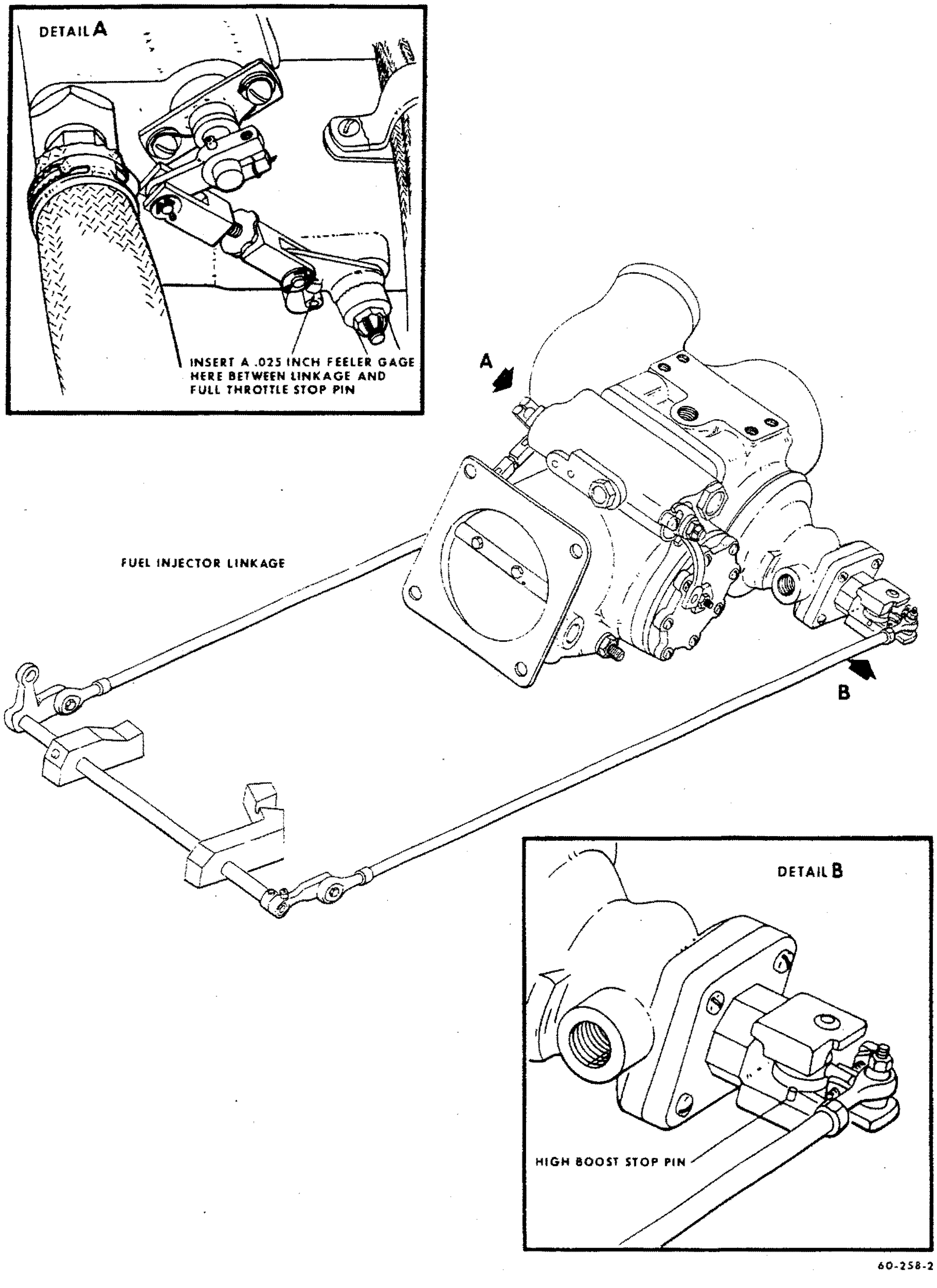
Do not exceed 41.5 in. Hg manifold pressure.

f. Repeat steps "b." through "e." until the manifold pressure at full throttle is 41 in. Hg.

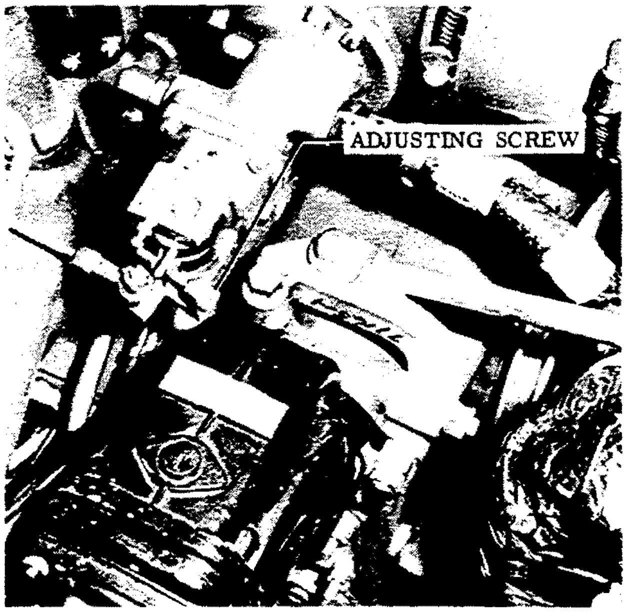
LUBRICATION OF WASTEGATE BUTTERFLY SHAFTS

Rust deposits may form in the area of the wastegate butterfly shaft bosses as a result of water vapor accumulation if the aircraft is subjected to short intervals of engine operation.

This condition occurs only when the unit is new and combustion deposits have not formed a protective barrier



Throttle and Turbocharger Controller Adjustment
Figure 201



Variable Pressure Controller
Figure 202

on the shaft surface. Units which are binding after long service time are coked internally and must be removed for cleaning or replacement.

When this condition is noted, remove the exhaust discharge stack and apply Mouse Milk or Kano Kroil (37, Chart 207, 91-00-00) liberally to the shaft and boss. After a few minutes attempt to turn the shaft. A light tap on the shaft end will assist in freeing the shaft. Once the shaft is free the engine may be started and a power check made to confirm the turbocharger output, either on the ground or in flight.

ADJUSTMENT OF TURBOCHARGER WASTEGATE VALVE

(Figure 203 or 204)

The linkage connecting the butterfly valve to the actuator is adjustable. It is adjusted at the time of valve installation so that the piston in the actuator cylinder bottoms at the same time, or just before, the butterfly valve seats in its bore. Misadjustment of the linkage may cause the butterfly valve to seat before the actuator piston bottoms and will result in damage to the linkage, as the hydraulic closing forces are high at engine idle or during cold engine operation. The linkage adjustment is used to establish critical altitude, which is the altitude at which the wastegate butterfly just fully closes. The adjustment must be made with full hydraulic or air pressure applied to the inlet port of the wastegate actuator. The full open butterfly stop adjustment, located on the center of the actuator cover, may be adjusted to stop the butterfly at the position required for safe engine operation. In the event the butterfly valve fails to close or fully open, adjustment of the valve is made as follows:

a. Disconnect both the inlet and outlet oil lines at the wastegate actuator. Plug the actuator outlet port and connect an air pressure supply line to the inlet port. This line must have a pressure gage installed to maintain 50-60 psi into the wastegate actuator.

b. Loosen the locknut on the adjusting turnbuckle and remove the cotter pin, washers and pin.

c. Apply 50 - 60 psi to the wastegate actuator and adjust the closed position of the wastegate butterfly valve by rotating the turnbuckle counterclockwise to fully close the wastegate butterfly. After the butterfly has made contact with the bore, back off the turnbuckle clockwise until the hole and slot align.

NOTE

Maintain a clearance of .005 to .025 (P-4 through P-143), .005 to .015 (P-144 and after) between butterfly edge and bore.

d. Reinstall the pin, washer and cotter pin. Tighten the locknut against the clevis with 80 to 100 in-lbs. torque.

e. With zero air pressure in the wastegate actuator, adjust the full open stop position of the butterfly valve with the adjusting screw located on the end of the actuator.

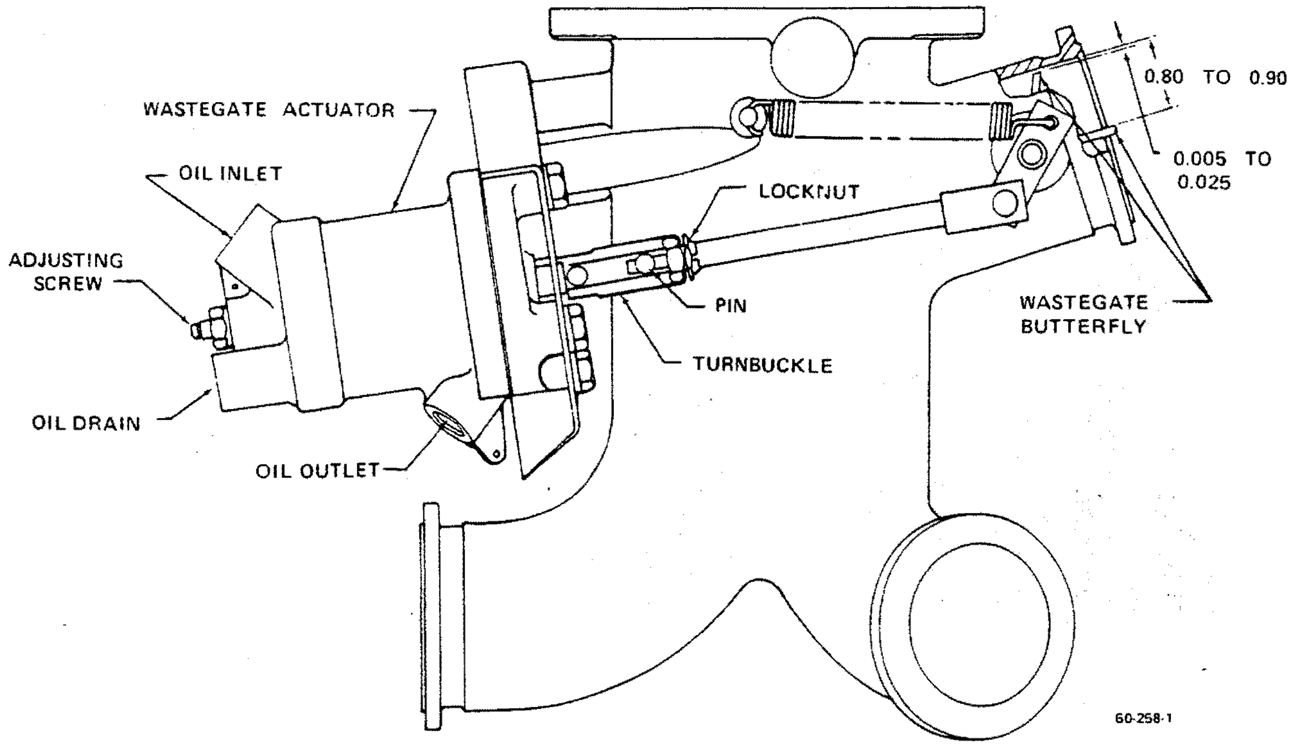
NOTE

Maintain a minimum clearance of .80 to .90 (P-4 through P-143), .730 to .750 (P-144 and after) between butterfly edge and bore.

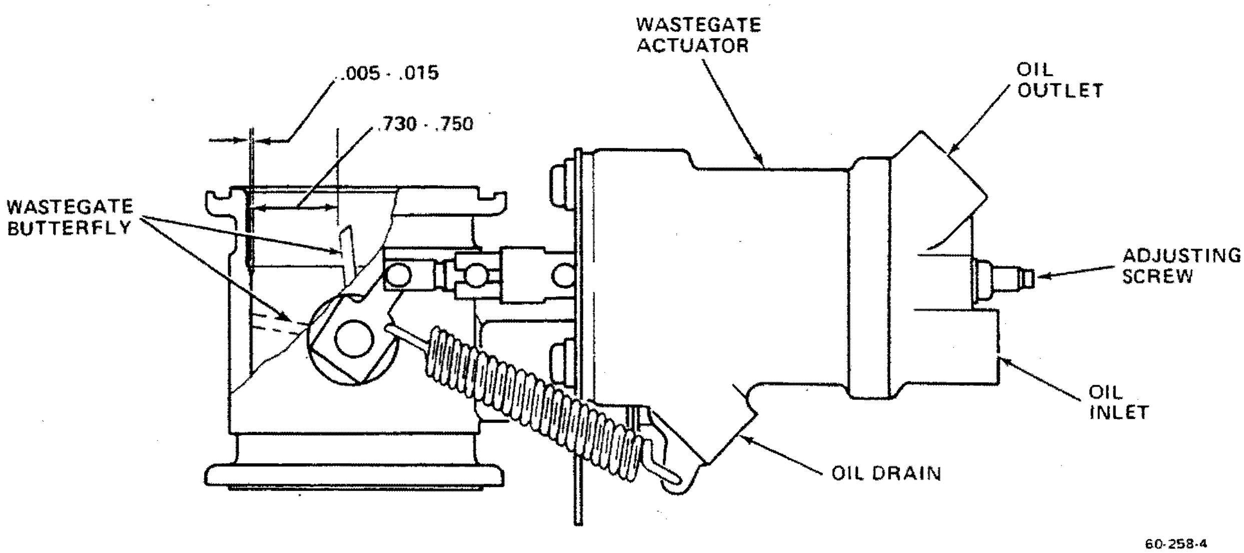
TURBOCHARGER CRITICAL ALTITUDE TEST

(Figure 205)

The following procedure provides a means of checking turbocharger performance. Refer to the Turbocharger Performance Graph. This graph indicates the minimum acceptable critical altitude the aircraft can achieve while maintaining 41.0 in. Hg manifold pressure. To check the turbocharger performance against the graph it will be necessary to flight test the aircraft. Place the aircraft in a climb configuration and note the altitude at which the manifold pressure begins to drop off; then observe the outside air temperature gage. Locate these points on the axes of the graph and project lines from these points toward the center of the graph. The point at which the lines intersect is the aircraft's critical pressure altitude. If this point is located below the minimum acceptable pressure altitude line on the graph, a thorough check of the turbocharging system, including variable controller, induction system leaks and wastegate adjustment, should be accomplished.

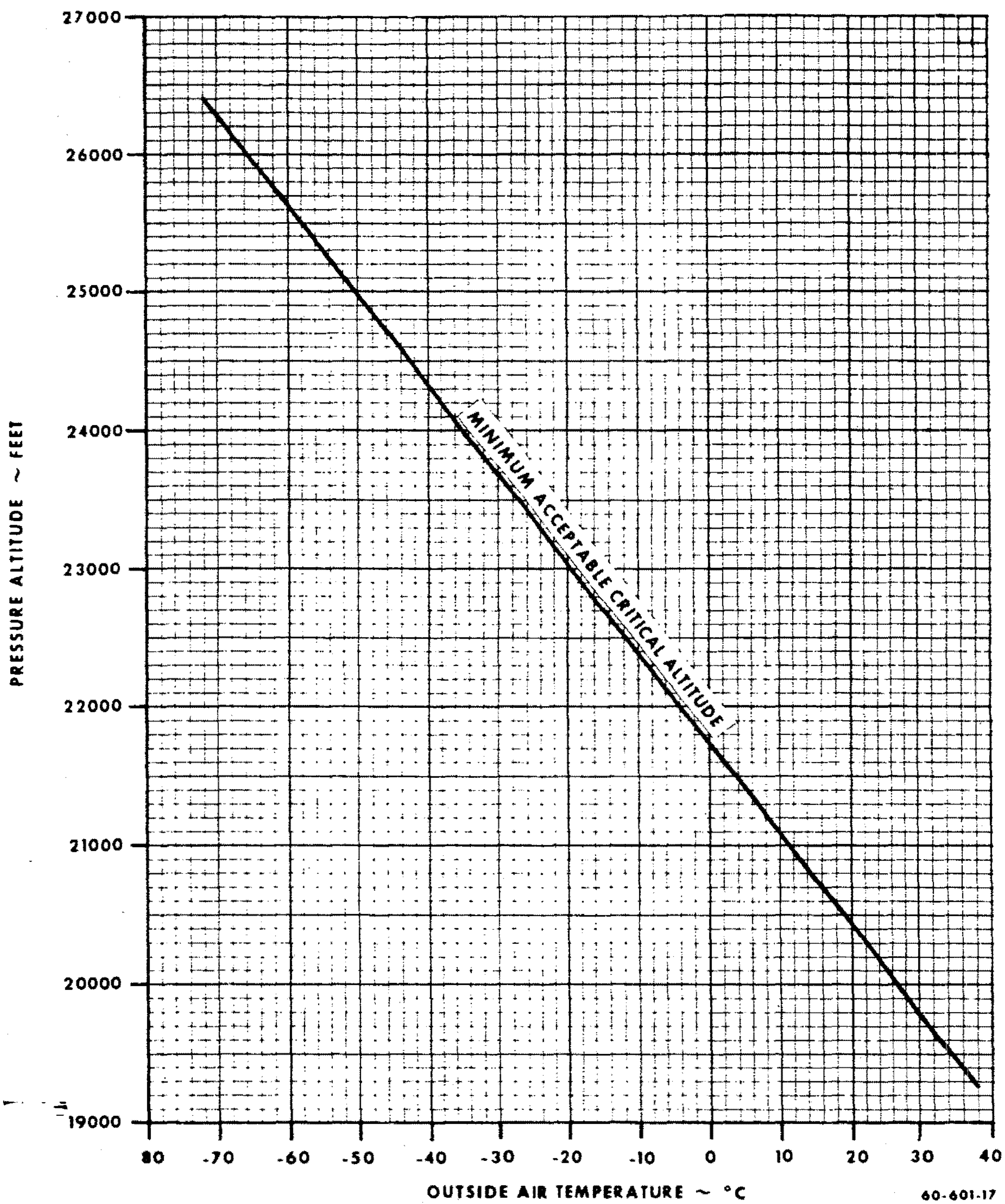


Wastegate Adjustment (P-4 thru P-143)
Figure 203



Wastegate Adjustment (P-144 and after)
Figure 204

CRITICAL PRESSURE ALTITUDE VS OAT



Turbocharger Performance Graph
Figure 205

"END"

CHAPTER 91

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CHART 201

TABLE OF TORQUES

ENGINE MOUNTING

Engine Mount Bracket Bolts And Nuts (At Firewall)	350 to 390 in. lbs.
Engine Shock Mount Bolts And Nuts	250 to 300 in. lbs
Engine Mounting Bracket Bolts	270 in. lbs.

ENGINE COMPONENTS

Air Conditioner Compressor Mounting Nuts	160 to 190 in. lbs.
Generator Mounting Bracket Bolts (Side Bracket)	150 in. lbs.
(Bottom)	75 in. lbs.
Engine Spark Plugs	360 to 420 in. lbs.
Engine Spark Plug Lead Connections	25 in. lbs.
Engine Oil Filter Retainer Bolt	25 to 30 ft. lbs.
Propeller Starter Gear/Slip Ring to Crankshaft	60 to 70 in. lbs.
Turbocharger Exhaust Clamp P/N MVT-68637-450-M	50 to 60 in. lbs.

HORIZONTAL AND VERTICAL STABILIZER

All 5/16 - 24 bolts	100 to 140 in. lbs.
All 3/8 - 24 bolts	160 to 190 in. lbs.

WING MOUNTING

NOTE

Wing mounting bolt torque should be checked at the first 100 hour inspection and 100 hours after wing reinstallation, replacing a wing bolt(s) or adjusting the wing. If it is necessary to retorque the wing bolts at this time, the bolts should then be checked at the next 100 hour inspection. This check should continue at each 100 hour inspection until it is no longer necessary to retorque the bolts. Check bolt torque at the nut end only.

Leading Edge Wing Mounting Bolt (Dry Torque Only)	100 to 140 in.-lbs
Upper Front Wing Mounting Bolt ((Wet Torque Only)	2480/2600 in.-lbs
Upper Rear Wing Mounting Bolt (Wet Torque Only)	1180/1300 in.-lbs
Lower Rear Wing Mounting Bolt (Wet Torque Only)	2480/2600 in.-lbs
Lower Forward Wing Mounting Bolt (See Chapter 57-00-00 for Torquing Instructions)	

LANDING GEAR

Strut Connecting Arm Bolts	290 to 410 in. lbs.
Horizontal Brace Bolts	25 to 40 in. lbs.
Main Gear Axle Nut	15 to 20 ft. lbs.
Main Gear Hinge Bolts	250 to 800 in. lbs.

CHART 201 (Cont'd)

TABLE OF TORQUES

FUEL SYSTEM (Attaching Bolts For)

Filler Necks	45 to 55 in. lbs.
Nacelle Transmitter	45 to 55 in. lbs.
Leading Edge Fuel Cell Outlet Plate	20 to 30 in. lbs.
Transmitter	25 ± 5 in. lbs.
Fuel Boost Pump	45 to 55 in. lbs.
Access Plates	45 to 55 in. lbs.
Fuel Cell Interconnect Clamps	25 ± 5 in. lbs.
Rubber Fuel Nipple Clamps	25 ± 5 in. lbs.

HEATER SYSTEM

Spark Plug	28 ft. lbs.
Spark Plug High Voltage Lead	20 ft. lbs.
Fuel Spray Nozzle	20 ft. lbs.

CHART 202

TORQUING FINE THREAD SERIES BOLTS LOADED IN SHEAR

NOTE

The following torque values may be used as a guide when specific torques are not called out within this manual.

SIZE	*TORQUE LIMITS RECOMMENDED (INCH-POUNDS)* AN365 AND AN310 NUTS COLUMN 1	AN364 AND AN320 NUTS COLUMN 2	*MAXIMUM ALLOWABLE TORQUE (INCH-POUNDS)* AN365 AND AN310 NUTS COLUMN 3	AN364 AND AN320 NUTS COLUMN 4
8-36	12-15	7-9	20	12
10-32	10-25	12-15	40	25
1/4 - 28	50-70	30-40	100	60
5/16 - 24	100-140	60-85	225	140
3/8 - 24	160-190	95-113	390	240
7/16 - 20	450-500	270-300	840	500
1/2 - 20	480-690	290-410	1100	660
9/16 - 18	800-1000	480-600	1600	960
5/8 - 18	1100-1300	660-780	2400	1400
3/4 - 16	2300-2500	1300-1500	5000	3000
7/8 - 14	2500-3000	1500-1800	7000	4200
1 - 14	3700-5500	2200-3300	10000	6000
1 - 1/8 - 12	5000-7000	3000-4200	15000	9000
1 - 1/4 - 12	9000-11000	5400-6600	25000	15000

NOTE

The above values apply to Class 3 threads, cadmium plated and non-lubricated.

CHART 203

TORQUING COARSE THREAD SERIES BOLTS LOADED IN SHEAR

SIZE	*TORQUE LIMITS RECOMMENDED (INCH-POUNDS)* AN365 AND AN310 NUTS COLUMN 1	AN364 AND AN320 NUTS COLUMN 2	*MAXIMUM ALLOWABLE TORQUE (INCH-POUNDS)* AN365 AND AN310 NUTS COLUMN 3	AN364 AND AN320 NUTS COLUMN 4
8-32	12-15	7-9	20	12
10-24	20-25	12-15	35	21
1/4 - 20	40-50	25-30	75	45
5/16 - 18	80-90	48-55	160	100
3/8 - 16	160-185	95-110	275	170
7/16 - 14	235-255	140-155	475	280
1/2 - 13	400-480	240-290	880	520
9/16 - 12	500-700	300-420	1100	650
5/8 - 11	700-900	420-540	1500	900
3/4 - 10	1150-1600	700-950	2500	1500
7/8 - 9	2200-3000	1300-1800	4600	2700
1 - 8	3700-5000	2200-3000	7600	4500
1 - 1/8 - 8	5500-6500	3300-4000	12000	7200
1 - 1/4 - 8	6500-8000	4000-5000	16000	10000

NOTE

The above values apply to Class 3 threads, cadmium plated and non-lubricated.

CHART 204

FLARE FITTING TORQUE CHART

TORQUE – INCH-POUND

TUBING OD INCHES	*ALUMINUM - ALLOY AND TUBING FLARE 10061 OR AND 10078*		*STEEL TUBING FLARE AND 10061*		*HOSE END FITTING AND HOSE ASSEMBLIES*	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
1/8	---	---	---	---	---	---
3/16	---	---	90	100	70	100
1/4	40	65	135	150	70	120
5/16	60	80	180	200	85	180
3/8	75	125	270	300	100	250
1/2	150	250	450	500	210	420
5/8	200	350	650	700	300	480
3/4	300	500	900	1000	500	850
1	500	700	1200	1400	700	1150
1-1/4	600	900	---	---	---	---
1-1/2	600	900	---	---	---	---
1-3/4	---	---	---	---	---	---
2	---	---	---	---	---	---

INSTALLATION OF FLARED FITTINGS

When installing flare fittings, make sure the male threads are properly lubricated in accordance with Chart 208. Torque the fittings in accordance with Chart 204 above. Do not overtorque.

CHART 205

SEALING MATERIALS

SEALING

Because the BEECHCRAFT Duke is a pressurized aircraft, sealing the skin and bulkhead seams, the windows, doors, etc., is of prime importance. Control cables and torque shafts have removable rubber seals. When making a structural repair or modification which creates a break in the pressure vessel, the mating surfaces must be sealed with the proper sealer. All other components piercing the pressure vessel or attached to it must be sealed with the sealers described in Chart 205. To assure effective bonding of the sealers, be sure to clean all mating surfaces, mating parts and rubber seals thoroughly.

ITEM	*PRODUCT*	*VENDOR*
1.	A56B Cement	B. F. Goodrich Co., Akron, Ohio
2.	EC-2141	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
3.	Permatex Sealer No. 2	Permatex Co., Inc., Kansas City, Kansas
4.	Presstite Sealer No. 155	Presstite Engineering Co., St. Louis, Missouri
5.	EP-711 Sealer	Coast Pro Seal and Mfg. Co., Los Angeles, California
6.	EC-1792	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
7.	EC-1239 Sealer	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
8.	Y-9136 Teflon Tape	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
9.	PR-1221 Sealer	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
10.	EC-750	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
11.	EC-801	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
12.	EC-1300L	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
13.	EC-612	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
14.	EC-776	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
15.	EC-801A-1/2	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
16.	EC-1368	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota

Chart 205 (Cont'd)

SEALING MATERIALS

ITEM	*PRODUCT*	*VENDOR*
17.	EC-1403	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
18.	Bostic 1008	United Shoe Machinery Corp., B. B. Division, 748 Memorial Drive, Cambridge, Massachusetts
19.	Pro Seal 890 B-1/2	Coast Pro-Seal and Manufacturing Co., Los Angeles, California
20.	EC-1675 B-1/2	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota

NOTE

Proper procedure for applying the sealers may be found in the directions on the sealer container and/or in the chapter of this manual applying to that area being worked.

CHART 206

APPLICATION OF SEALING MATERIALS

APPLICATION	*MATERIAL*	*REMARKS*
Metal Surfaces and Wet Wing Tip	O-A-51, Acetone; MIL-M-13999, Methyl Ethyl Ketone; *TT-N-95, Naphtha	Clean all surfaces prior to application of adhesive or sealer. Adhesives or sealers may be applied to zinc chromate primed surfaces.
Synthetic or Natural Rubber	MIL-M-13999, Methyl Ethyl Ketone; TT-T-548, Toluol	Clean all surfaces to be bonded. Where possible, scuff surface by wire brushing or sanding.
Silicone Rubber	TT-X-916, Zylene	Clean all surfaces with zylene only when a surface lubricant, i.e. soapstone has been applied by the manufacturer.
Rubber Door Seals	EC-847	Rubber seals are installed to prevent air leakage. The seals must be cut with mitered corners to fit the periphery of the door jam. Apply a thin coating of adhesive to both the areas where the seal will be placed and the side of the seal to be bonded. Allow to dry completely, then lightly wipe the surface to be bonded with a cloth dampened with MIL-M-13999 methyl ethyl ketone to reactivate the adhesive. Position the seal carefully as it has immediate adhesion when laid in place.
Unused Drill Holes	EC-1239, *PR-890 B-1/2 or *EC-1675 B-1/2	Plug holes which go through pressure boundaries with rivets, or seal with EC-1239.
Plumbing Fittings	EC-1239 B-1/2 or PR-1221 B8	Apply to all plumbing fittings which pass through a pressure boundary.
Electrical Fittings	EC-1239, EC-776	Seal all electrical plugs which pass through a pressure boundary with EC-1239. Apply EC-776 on the screw head used for attachments upon completion of the installation.

CHART 206 (Cont'd)

APPLICATION OF SEALING MATERIALS

APPLICATION	*MATERIAL*	*REMARKS*
Faying Surface Seal	PR-1221 B8, EC-1239 B-1/2 EC-1792 *PR-890 B-1/2 *EC-1675 B-1/2	Apply with a bead approximately 1/8 to 3/16 inch in height, depending on the width of the lapped skin or angles. Apply sufficient sealant so there will be a slight squeeze out of sealant along the edge on the pressure side of the assembly when the assembly is completed.
Fillet Seal	PR-1221 B8, EC-1239 B-1/2 *PR-890 B-1/2 *EC-1675 B-1/2	Apply with a gun capable of extruding beads at least three times the thickness of the skin being sealed. Work the tip of the gun so it packs the sealant into the cracks, crevices or skin lap. The fillet must make complete contact with the immediate area.
Gap Seal	EC-1239 *PR-890 B-1/2 *EC-1675 B-1/2	Apply with a gun or spatula over the edges of the flanges forming at least 1/4 inch lap with a center thickness of 1/4 to 1/2 inch, depending on the size of the hole. Gaps and voids larger than 3/8 inch in two dimensions should be sealed with a mechanical closure.
Coating Seal	EC-776 *PR-890 B-1/2 *EC-1675 B-1/2	Apply as necessary to prevent pressure leaks on an area double the size of the rivet butt, working the sealer with the brush to insure that the rivet is completely covered.
Window Seal	EC-1202	Apply around periphery of all window panels prior to installation in frames. Tape width is to extend equally on both sides of panels.
Sealant Ribbon	Prestite 155	Apply around periphery of all removable inspection doors and panels.

*Wet Wing Tip

CHART 206 (Cont'd)

APPLICATION OF SEALING MATERIALS

TERMS

Faying Surface Seal refers to a seal where the sealing material is applied between the joint surfaces before assembly.

Fillet Seal refers to a seal over a joint or seam that fills the gap. It is not to be applied in the nature of a bridge.

Gap Seal refers to a seal where the sealing material is packed into a gap or void and lapped over the edges. These seals should not be used on gaps or voids larger than 3/8 inch in two dimensions.

Pot Life refers to the workable life of a two-part sealant mixture.

Sealing Ribbon refers to an extruded section ribbon sealer used on removable inspection doors.

Sealing Tape refers to a sealer made in the form of a tape and supported by a loose woven tobacco cloth. This tape is used in areas where a wide flat layer of sealer is required, such as a window installation.

CHART 207

CONSUMABLE MATERIALS

Only the basic number of each Military Specification is included in the Consumable Materials Chart. No attempt has bee made to update the basic number with the letter suffix that designates the current issues of the various specifications.

Vendors that are listed as meeting the Federal and Military Specifications are provided as reference only and are nc specifically recommended by Beech Aircraft Corporation; consequently, any product conforming to the specification listed ma be used. The products listed below have been tested and approved for aviation usage by Beech Aircraft Corporation, th vendor, or by compliance with the applicable specifications. Other products that are locally procurable which conform to th requirements of the applicable Military Specification may be used even though not specifically included herein.

It is the responsibility of the operator/user to determine the current revision of the applicable Military Specification prior t usage of that item. This determination may be made by contacting the vendor of a specific item.

ITEM	*MATERIAL*	*SPECIFICATIONS*	*VENDOR PRODUCTS*
1.	Fuel, Engine	100/130 octane (If not available, use 115/145) Never use 91/96 octane fuel.	
2.	Oil, Engine (Ashelss Disperant)	MIL-L-22851	Global Concentrate A Delta Petroleum Company Inc., P. O. Box 10397 New Orleans, La. 70121 Paranox 160 and 165 Enjay Chemical Company 60 West 49th Street New York, N. Y. 10020 RT-451, RM-173E, RM-180E Mobil Oil Corporation 150 East 42nd Street New York, N. Y. 10017 Shell Concentrate A Code 60068, Aeroshell W120, Aeroshell W80 Shell Oil Company One Shell Plaza Houston, Texas 77002 TX-6309 Aircraft Engine Oil, Premium AD120, Premium AD80 Texaco Inc. 135 East 42nd Street New York, N. Y. 10017 PQ Aviation Lubricant 753 American Oil and Supply Co. 238 Wilson Avenue Newark, N. J. 07105

CHART 207 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
2.	Oil, Engine (Ashless Dispersant) (Cont'd)	MIL-L-22851	Chevron Aero Oil Grade 120 Chevron Oil Co. 1200 State Street Perth Amboy, N. J. 08861
			Esso Aviation Oil E-120, Enco Aviation Oil E-120, Esso Aviation Oil A-100. Enco Aviation Oil A-100, Esso Aviation Oil E-80, Enco Aviation Oil E-80
			Enco Aviation Oil E-80 Exxon Company, U.S.A. P. O. Box 2180 Houston, Texas 77001
			Chevron Aero Oil Grade 120 Standard Oil Co. of Calif. 225 Bush Street San Francisco, Calif. 94120
3.	Corrosion Preventive Compound	MIL-C-6529	Anti-Corrode No. 205 Cities Service Oil Co. 60 Wall Tower, New York 5, N. Y.
			Rust Foil No. 652-2, Franklin Oil and Gas Co., Bedord, Ohio
			Kendex No. 7038, Kendall Refining Co., Bradford, Pa.
4.	Lubricating Oil	MIL-L-6081	Gulflite Turbojet Oil No. 1010, Gulf Oil Corp. Pittsburgh, Pa.
			Aeroshell No. 3-1286, Shell Oil Co., 50 West 50th Street, New York, N. Y. 10020
			Jet Engine Oil No. 1010, Texaco Inc., 135 East 42nd Street, New York N. Y. 10017

CHART 207 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
5.	Lubricating Oil	SAE 20 or SAE 10W30	
6.	Lubricating Oil, Aircraft Reciprocating (Piston) Engine	MIL-L-6082	Conoco Aero Oil No. 1065, Continental Oil Co. Ponca City, Oklahoma Phillips 66 Aviation Engine Oil, Grade 1065 Phillips Petroleum Co. Bartlesville, Oklahoma Skelflite No. 100, Skelly Oil Co., El Dorado, Kansas Avrey 10V1100, Socony Mobil Oil Co. Inc., 150 East 42nd Street, New York, N. Y. 10017 Or any approved airplane engine oil (graded at 1065 or 1100).
7.	Lubricating Oil (Gear)	MIL-L-6086 Grade M	Trojan Gear Oil No. 6086 M. Cities Service Oil Co., 60 Wall Tower, New York 5, N. Y. Aeroshell Fluid 5 M, Shell Oil Co., 50 West 50th Street, New York, N. Y. L-1195, Sinclair Refining Co., 600 Fifth Avenue, New York, N. Y.
8.	Lubricating Grease (General Purpose)	MIL-G-7711 (Superseded by MIL-G-81322, See Item 9)	

CHART 207 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
9.	Lubricating Grease NOTE MIL-G-81322 is not compatible with Aeroshell No. 5 and contains chemicals harmful to painted surfaces.	MIL-G-81322	Mobilgrease 28 Mobil Oil Corporation Shoreham Building Washington D.C. 20005 Aeroshell 22, Shell Oil Co., 50 West 50th Street, New York, N. Y.
10.	Lubricating Grease (Gear)	Mobile Compound G. G.	
11.	Lubricating Grease (Aircraft and Instruments, Low and High Temperature) NOTE Precautions should be taken when using MIL-G-23827 and MIL-G-81322, since these greases contain chemicals harmful to painted surfaces.	MIL-G-23827	Supermil Grease No. A72832, American Oil Co., 910 South Michigan Avenue Chicago, Ill. 60680 Royco 27A, Royal Lubricants Co., River Road, P. O. Box 95, Hanover, N. J. 07936 Shell 6249 Grease, Shell Oil Co., 50 West 50th St., New York 20, N. Y.
12.	Lubricant, Molybedenum Disulfide Powder	MIL-M-7866	Molykote Z Wilco Co., Wichita, Kansas Molykote Z Standard Oil of Kentucky Molykote Z, Haskell Engineering and Supply Company, 100 East Graham Place Burbank, California 91502 Moly-Paul No. 4, K. S. Paul Products Ltd. Nobel Road, London, England

CHART 202 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
13.	Hydraulic Fluid	MIL-H-5606	Brayco 756D, Bray Oil Co., 3344 Medford Street, Los Angeles 63, California PED 3656 Standard Oil Co. of California 225 Bush Street, San Francisco 20, California
14.	Oxygen-System Leak Testing Compound	MIL-L-25567	
15.	Solvent, Dry Cleaning or White Spirit	PD680 or British Specification 245	
16.	Lubricating Oil	SAE-10	
17.	Air conditioner Refrigerant	R-12	
18.	Oil (Air Conditioner Compressor) 500 Viscosity		Suniso No. 5 Virginia Chemical and Smelting Co., West Norfolk, Virginia Texaco Capella E, Texaco Inc., 135 East 42nd Street, New York, N. Y. 10017
19.	Aviator's Breathing Oxygen	MIL-O-27210	
20.	Naphtha	TT-N-95	
21.	Methyl Ethyl Ketone	MIL-M-13999	
22.	Toluol (Toluene)	TT-T-548	
23.	Paint Remover		Turco No. 4260 Turco Products Inc., Los Angeles, California
24.	Epoxy Primer		Ameron Industrial Coatings Division P.O. Box 2153, Wichita, Kansas

CHART 207 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
25.	Wash Primer		Ameron Industrial Coatings Division P.O. Box 2153, Wichita, Kansas
26.	Zinc Chromate Primer	MIL-P-8585	
27.	Rubber Hose	MIL-H-5593	
28.	Oil, Engine Preservative	MIL-L-21260	
29.	Graphite, Lubricating NOTE Lubricating Graphite Superseded by Item 12	SS-G-659 (Supersedes MIL-G-6711)	Anchor Packing Co., 401 Broad St. Philadelphia, PA. 19108 Bel-Ray Co., Inc:, P.O. Box 526, Farmingdale, N.J. 07727 Crane Packing Co., 6400 Oakton St., Morton Grove, Ill. 60053 Ducommum Inc., Super-Temp Div., 11120 S. Norwalk Blvd., Santa Fe Springs Ca. 90670
30.	Lubricating Grease	Enco Andok-B	Humble Oil Co. Houston, Texas
31.	Solvent		CRC-2-26, Corrosion Reaction Consultants Limeklim Pike, Dresher, Pa.
32.	Laminated Glass Cloth	MIL-F-9084	Trevano, Coast Manufacturing and Supply Inc., Box 71, Livermore, California Uniglass, United Merchants and Manufacturing Inc. 1407 Broadway, New York, New York 10018
33.	Resin	MIL-R-7575	Laminac 4116, American Cyanamid Co., Wallingford, Connecticut Glidpol 1001, The Glidden Company, 925 Euclid Ave. Cleveland, Ohio

CONSUMABLE MATERIALS
CHART 207 (Cont'd)

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
34.	Lubricating Grease	Aeroshell 7A	Shell Oil Co., 50 West 50th Street, New York, N. Y.
35.	Urethane Primer		U. S. Paint Lacquer and Chemical Co., 1501 N. Belmont, P. O. Box 8151, Wichita, Kansas 67208
			Ameron Industrial Coatings Division P.O. Box 2153, Wichita, Kansas
36.	Thread Locking Compound	Loctite Sealant, Grade A	Loctite Corp. 705 N. Mountain Road Newington, Conn. 06111
37.	Penetrating Oil	Mouse Milk	Worldwide Aircraft Filters Corp., 1685 Abram Ct. San Leandro Calif. 94577
		Kano Kroil	Kano Laboratories Inc. Nashville, Tennessee
38.	Lubricating Grease	Aeroshell Grease 5,	Aeroshell Grease 5, Shell Oil Co., 50 West 50th Street, New York, N. Y.
39.	Cement	EC2262	Minnesota Mining and Manufacturing Company St. Paul, Minneosta
40.	Primer	Locquic "N"	Loctite Corp. 705 N. Mountain Road Newington, Conn. 06111
41.	Cleaner	Turco Metal-glo No. 3	Turco Products, Inc., Los Angeles, Calif.
42.	Paint Stripper	Turco 4260	Turco Products Inc. Los Angeles, California

CHART 207 (Cont'd)
CONSUMABLE MATERIALS

ITEM	MATERIAL	SPECIFICATIONS	VENDOR PRODUCTS
43.	Corrosion Preventive Compound	MIL-C-16173 Grade 2	Braycote 137, Bray Oil Co. 1925 N. Marianna Avenue Los Angeles, California 90032 Petrotech 1-4 Penreco, P.O. Box 671, Butler, Pa. 16001
44.	Lubricating Grease	MIL-G-7118	
45.	Primer, Degreasing	EC3911	Minnesota Mining and Manufacturing Co., St. Paul, Minnesota
46.	Lubricating Silicone	G-322L	General Electric Waterford, New York 12188
47.	Anti-Seize Compound	Loctite 76764 Paste Form 1 lb Bursh Top Can	Loctite Corp. 705 N. Mountain Road Newington, Conn. 06111
48.	Coating	Alodine 1200, 1200S or 1201	Amchem Products Inc. Spring Garden Street Ambler, Pennsylvania 19002

CHART 208

THREAD LUBRICANTS

The vendor products appearing in this chart have been selected at random to help field personnel determine products conforming to the specifications listed in this publication. The brand names are listed for ready reference and are not specifically recommended by Beech Aircraft Corporation. Any product which conforms to the referenced specification may be used.

SYSTEM	*MATERIAL*	*SPECIFICATION*	*VENDOR PRODUCTS*
Fuel	Petrolatum	VV-P-236	
Oil, Manifold Pressure, Air Pressure	Lubricating Grease (Gasoline and Oil Resistant)	MIL-G-6032	L-237, Lehigh Chemical Co. Chestertown, Maryland Rockwell 950, Rockwell Mfg. Pittsburgh 8, Pa. Royco 32, Royal Lubricants Co. Hanover, New Jersey
Deicer, Static, Pitot	Anti-Seize, White Lead Base	TT-A-580	Armite Product Armite Laboratories, Los Angeles, California
Autopilot (Pipe Threads Only)	Anti-Seize, White Lead Base	JAN-A-669	
Brakes	Hydraulic Fluid or Anti-Seize, White Lead Base	MIL-H-5606 or TT-A-580	
Air Conditioner	Anti-Seize, Graphite Petrolatum or Anti-Seize, White Lead Base	MIL-T-5544 or TT-A-580	
Oxygen, High Pressure Side	Tape, Tetrafluroethylene	MIL-T-27730	Permacel Tape Corp., New Brunswick, New Jersey
Turbocharger Inlet Probe	Anti-Seize Compound	MIL-A-907D	Anti-Seize Compound C5A, Fel-Pro Inc. 7450 McCormick Skokie, Illinois

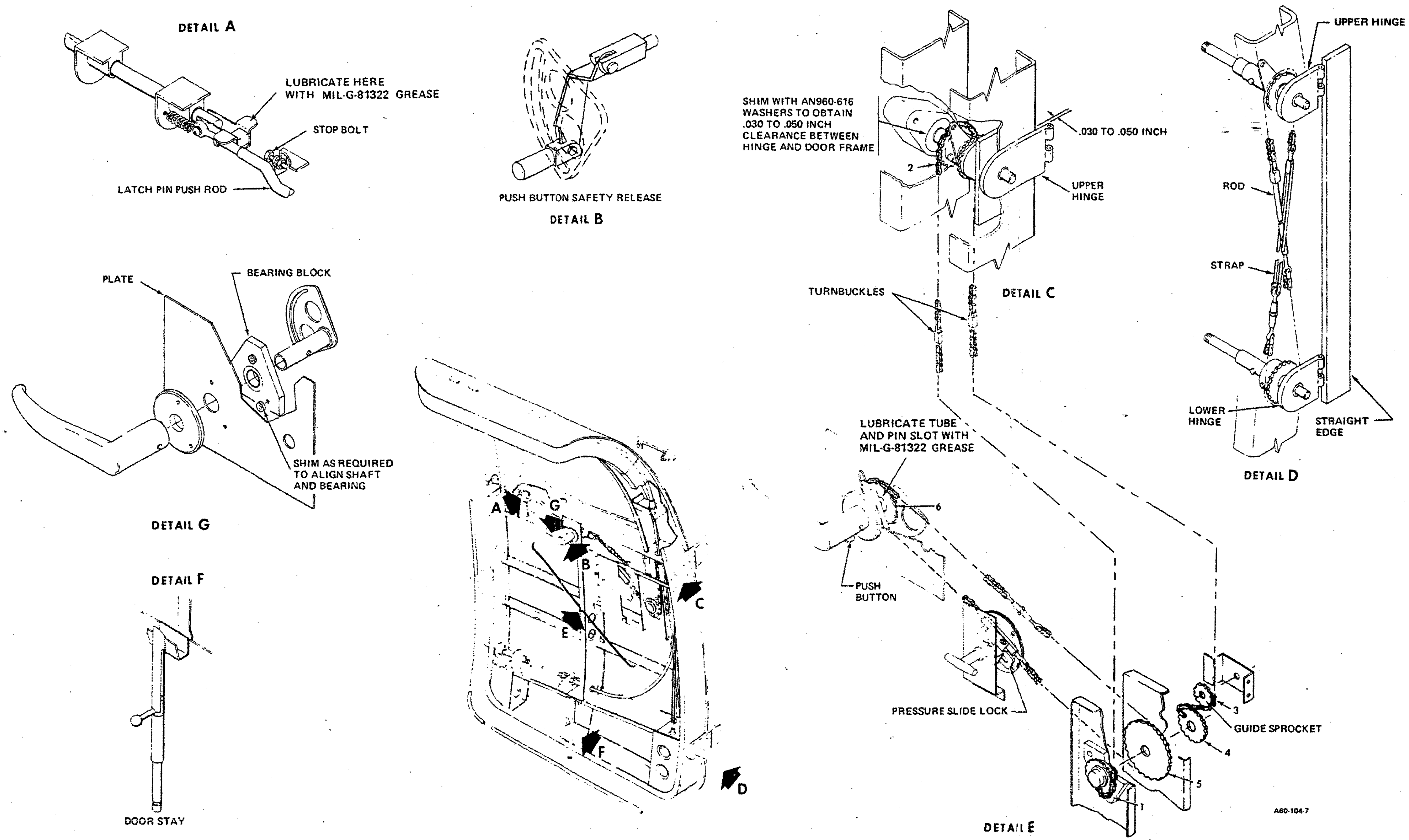
CHART 209

APPROVED ENGINE OILS (ASHLESS DISPERSANT)

SPECIFICATION	*PRODUCT*	**VENDOR*
MIL-L-22851	Global Concentrate A	Delta Petroleum Company, Inc. P.O. Box 10397 New Orleans, La. 70121
	Paranox 160 and 165	Enjay Chemical Company 60 West 49th Street New York, N.Y. 10020
	RT-451, RM-173E, RM-180E	Mobil Oil Corporation 150 East 42nd Street New York, N.Y. 10017
	Shell Concentrate A Code 60068 Aeroshell W120 Aeroshell W80	Shell Oil Company One Shell Plaza Houston, Texas 77002
	TX-6309 Aircraft Engine Oil Premium AD120 Aircraft Engine Oil Premium AD80	Texaco Inc. 135 East 42nd Street New York, N.Y. 10017
	PO Aviation Lubricant 753	American Oil and Supply Co. 238 Wilson Avenue Newark, N.J. 07105
	Chevron Aero Oil Grade 120	Chevron Oil Co. 1200 State Street Perth Amboy, N.J. 08861
	Esso Aviation Oil E-120 Enco Aviation Oil E-120 Esso Aviation Oil A-100 Enco Aviation Oil A-100 Esso Aviation Oil E-80 Enco Aviation Oil E-80	Humble Oil and Refining Co. P.O. Box 2180 Houston, Texas
	Chevron Aero Oil Grade 120	Standard Oil Co. of Calif. 225 Bush Street San Francisco, Calif. 94120

*The vendor products appearing in this chart have been selected at random to help field personnel determine products conforming to to the specifications in this publication. The brand names are listed for ready reference and are not specifically recommended by Beech Aircraft Corporation. Any product which conforms to the referenced specification may be used.

"END"



Cabin Door Mechanism (P-123, P-127 and after)
Figure 202

Check that the chains are positioned on sprockets (5 and 6, Detail E) so that the interior handle can be rotated for its full travel without interference between the chain turnbuckle and the sprockets.

NOTE

If the handle binds while being rotated, check the chain for proper deflection under firm thumb pressure as indicated in Detail E. Adjust the chain turnbuckle as necessary to obtain this deflection. If the chain is at the proper tension but the handle still binds, check for alignment of the plate and bearing (see Detail G) with the handle shaft. Shim between the bearing block and plate with AN960-10L washers as necessary to eliminate the misalignment.

e. Check that the lock bolt (P-4 thru P-126, except P-123) pulls aft to clear the lock (see Detail B, Figure 201) when the exterior handle is in the fully open position. If necessary, reposition the lock arm support at its slotted mounting holes to obtain this clearance.

f. Adjust the stop bolt (see Detail A) until the complete travel of the center latch bolt from the locked position is 1-1/4 inches.

CAUTION

To prevent damage to the ears of the spring in the exterior handle, (P-4 thru P-126, except P-123) the stop bolt must be adjusted to provide .010 to .030 inch clearance (see Detail F, Figure 201) between the ears of the spring and the lug in the casting of the handle when the handle reaches the limit of its travel.

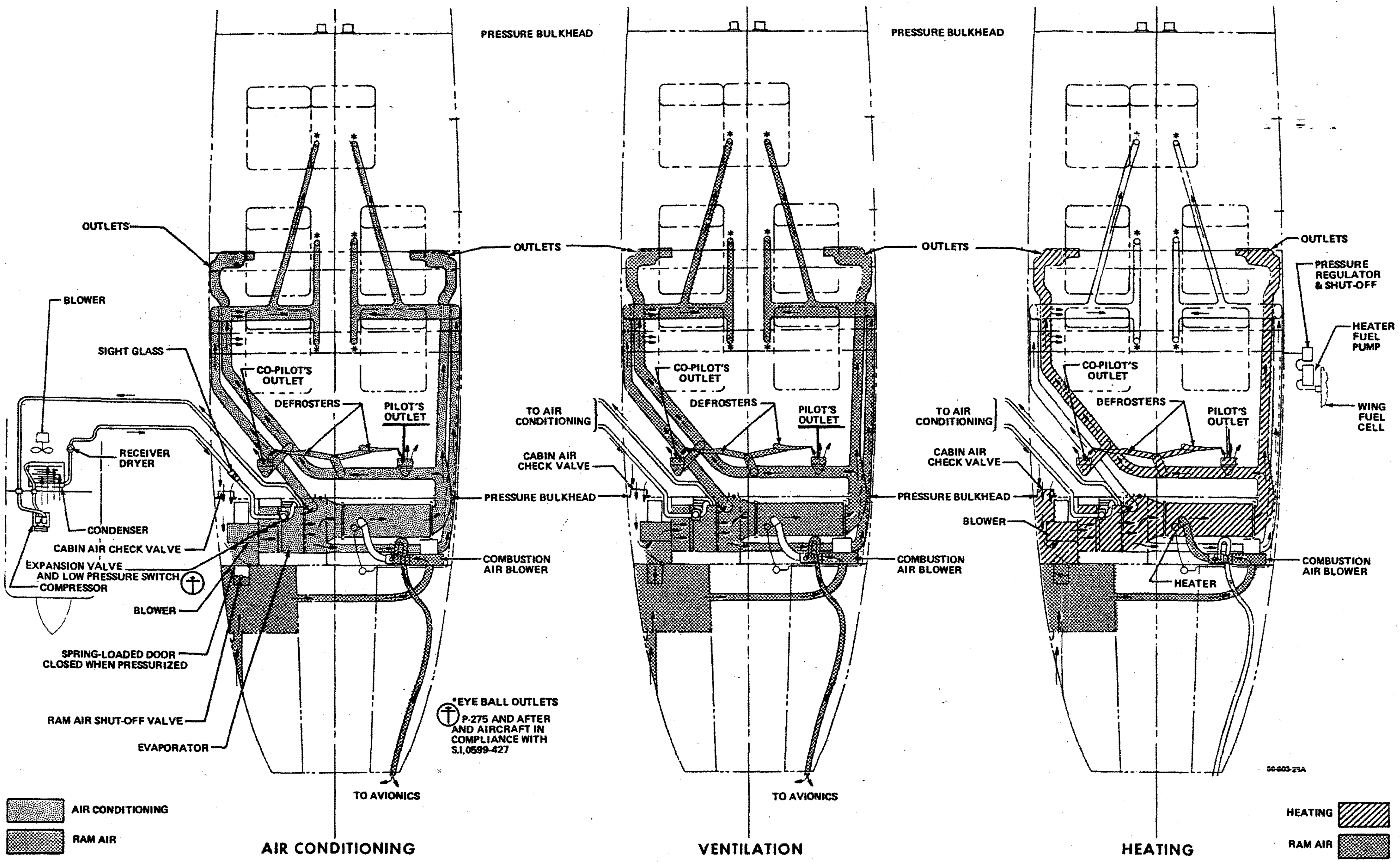
Check that the center latch pin extends 1-1/4 inches beyond the door frame when the hinges are in the closed position and 1/4 inch when in the open position. If necessary, adjust the length of the latch pin push rod (see Detail A) to obtain these settings.

g. Unsafety and adjust the length of the upper and lower latch pins until they extend one inch beyond the door frame with the hinges in the closed position.

LUBRICATION OF CABIN DOOR LATCHING MECHANISM

The latch mechanism is lubricated upon assembly and will not normally require further lubrication except when parts are replaced, then the chains and all points of friction except oilite bearings should be lubricated with MIL-G-81322 grease (9, Chart 207, 91-00-00).

"END"



Air Conditioning Distribution System (P-247 and after)
Figure 203

"END"

PASSENGER/CREW - MAINTENANCE PRACTICES

CABIN DOOR REMOVAL

a. Remove the upholstery panels adjacent to the hinges at the forward side of the door frame to gain access to the hinge attaching points.

b. Disconnect the electrical leads for the cigarette lighter and door locked indicator light at the forward side of the door frame.

c. Remove the nut securing the shaft of each hinge assembly to the door frame.

d. Remove the door by pulling the hinge shafts out of the mounting holes in the door frame.

CABIN DOOR INSTALLATION

a. Align the door with the door frame and insert the upper and lower hinge shafts into the mounting holes in the door frame.

b. Reinstall the washers that go between the hinge bearing mount and the shoulder of each hinge shaft.

c. Secure the hinges to the door frame structure with the attaching washer and nut. Check for a clearance of .03 to .05 inch between the hinge half and the door frame throughout the arc of the hinge rotation as the door is latched and locked. Add AN960-616 or AN960-616L washers as necessary between the hinge bearing mount and the shoulder of each hinge shaft to obtain this clearance.

d. Make any adjustments necessary for proper operation of the latch mechanism.

DOOR LATCH ADJUSTMENT
(Figures 201 and 202)

The following adjustments are possible only if the latch mechanism is properly rigged:

a. Unsafety and adjust the length of the upper and lower latch pins until they extend one inch beyond the door frame with the hinges in the closed position.

b. Adjust the stop bolt (see Detail A) until the complete travel of the center latch bolt from the locked position is 1-1/4 inches.

CAUTION

To prevent damage to the ears of the spring in the exterior handle (P-4 thru P-126, except P-123) the stop bolt must be adjusted to provide .010 to .030 inch clearance (see Detail F, Figure 201) between the ears of the spring and the lug in the casting of the handle when the handle reaches the limit of its travel.

Check that the center latch pin extends 1-1/4 inches beyond the door frame when the hinges are in the closed position and 1/4 inch when in the open position. If necessary, adjust the length of the latch pin push rod to obtain the foregoing settings.

c. If the proper settings cannot be obtained by the preceding adjustments, the latching mechanism must be rerigged.

LATCH MECHANISM RIGGING
(Figures 201 and 202)

The door latch mechanism is prerigged at the factory and should not normally require further adjustment except when damaged parts, such as chains and sprockets, require replacement. After removing all upholstery panels from the door to gain access to the latching mechanism, rig the door as follows:

a. Check for a clearance of .030 to .050 inch between each hinge half and the door frame throughout the arc of hinge rotation as the door is latched and locked. If necessary, add AN960-616 or AN960-616L washers between the shoulder of the hinge shaft and the hinge bearing (see Detail C) until the proper clearance is obtained.

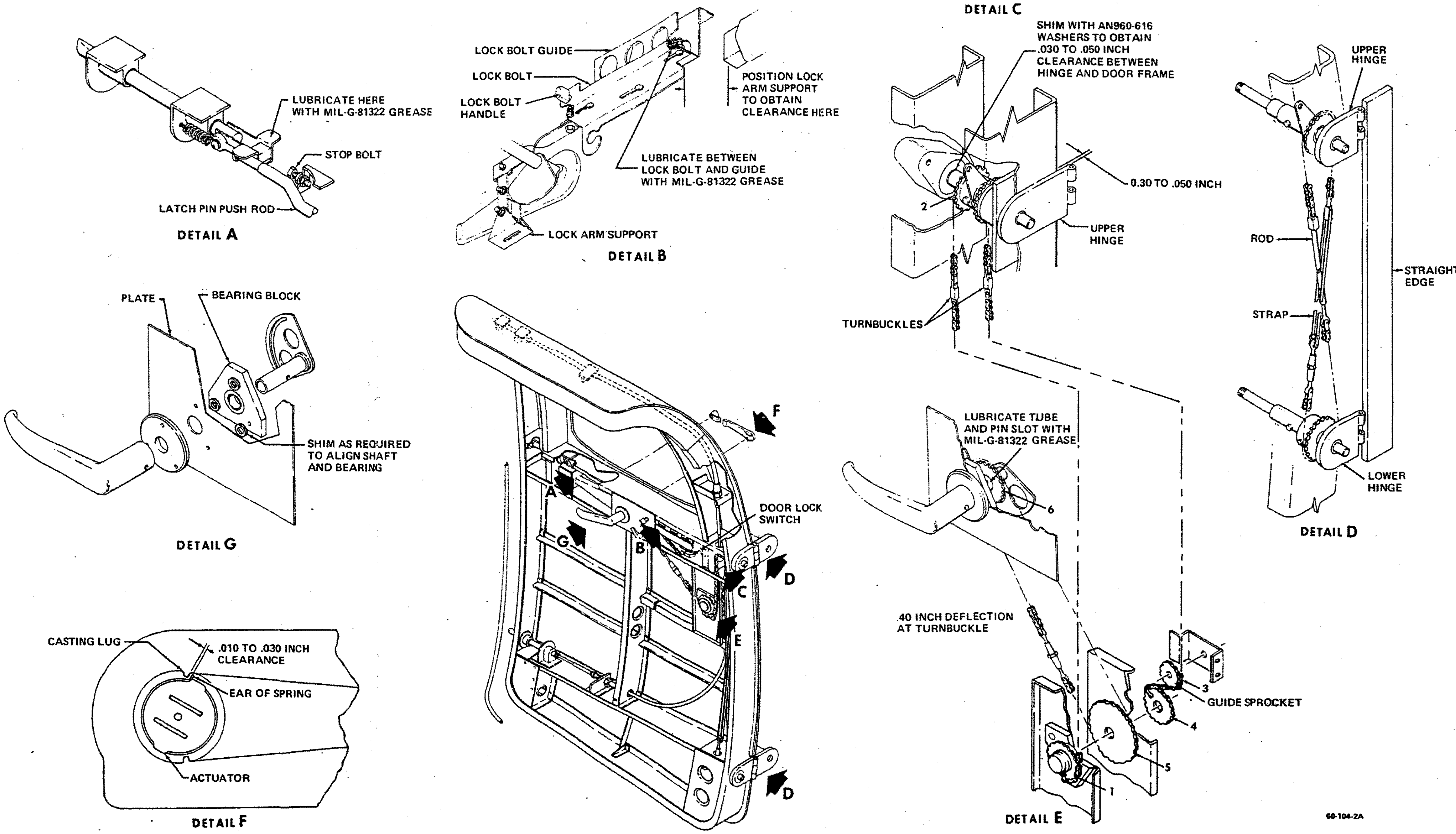
b. Use a straight edge to ascertain that the upper and lower hinge pins (see Detail D) are aligned with one another when the hinges are in the fully open position. Adjust the position of the chains on the upper and lower sprockets until the hinges can be rotated to the fully closed position without interference between the strap or rod terminals and the chain sprockets.

c. Check that the chains are positioned on sprockets (1, 2, 3, and 4, Details C and E) so that the hinges can be rotated to the fully open position without interference between the turnbuckle terminals and sprockets.

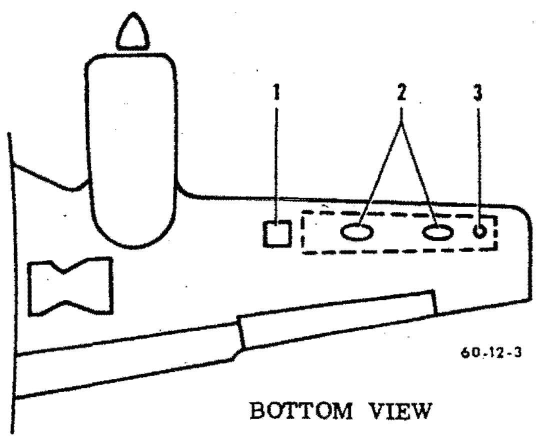
d. Align the hinges with the straightedge and place the interior handle in the fully open position.

NOTE

If the chain between sprockets (5 and 6, Detail E) has been removed, it must be reinstalled at this point. The chain must be installed with the exterior handle in the neutral position and the interior handle in the fully open position to avoid overloading the latching mechanism requiring excessive force to turn the door handles.



Cabin Door Mechanism (P-4 thru P-126, except P-123)
Figure 201



1. Fuel Plumbing Access
2. Fuel Cell Access
3. Filler Neck

**Outboard Leading Edge Fuel Cell
Access Openings
Figure 205**

f. Unsnap the fuel cell and remove it from the wing cavity through one of the access openings (2).

NOTE

Tape the edge of the access hole to protect the fuel cell during removal and installation. If the fuel cell is to be stored for a period of 10 days or longer, coat the inside of the cell with light engine oil to prevent cracking or deterioration.

OUTBOARD LEADING EDGE FUEL CELL INSTALLATION

a. Carefully insert the fuel cell into the wing cavity through access openings (2) and snap in place.
b. Connect all fuel and vent plumbing. Torque the rubber fuel fitting nipples to 25 ± 5 inch-pounds.
c. Install the internal fuel cell interconnect clamps. Torque clamps to 25 ± 5 inch-pounds.
d. Install the access plates (2) and plumbing access plate (1) on the under side of the wing. Torque the access plates to 45 to 55 inch-pounds.
e. Install the filler neck with a new gasket. Torque the bolts to 45 to 55 inch-pounds and safety wire.

NOTE

Use sealer (3, Chart 205, 91-00-00) between the skin and the adapter flange when installing the filler neck.

WET WING TIP REMOVAL

a. Disconnect external power from the airplane. Place battery and generator switches in the off position.
b. Defuel the airplane, to the point where fuel cannot be seen from the inboard filler position.
c. Remove access plates from the outboard lower wing.
d. Remove deice boot from wing tip leading edge (if installed). (Refer to Chapter 30).
e. Working through the access opening in the under side of the wing, loosen the clamps on the 3 inch fuel interconnect and vent lines.
f. Disconnect the electrical connections.
g. Support wing tip. Using a 1/8 inch drill bit, drill out rivets along the connecting strap and remove the strap.
h. Remove the support angle screws at the juncture of the wing tip and wing front and rear spar. Remove the wing tip.

WET WING TIP INSTALLATION

a. Disconnect external power from the airplane. Place battery and generator switches in the off position.

CAUTION

Support the wing tip on a platform which will give firm support but will allow some flexibility of movement of the wing tip to facilitate proper alignment. Protect the wing tip surface from scratches, dents and other damage during installation.

b. Support the wing tip in the proper position to attach to the wing. Connect the hoses from the wing to the 3 inch fuel interconnect and vent lines. Secure with clamps.
c. Connect electrical connections.
d. Move wing tip into position and secure support angles to the front and rear spars with screws.
e. Using MS20426AD3 rivets, rivet the connecting strap to both the wing and wing tip.
f. Install the deicer boots (if required). (Refer to Chapter 30.)

NOTE

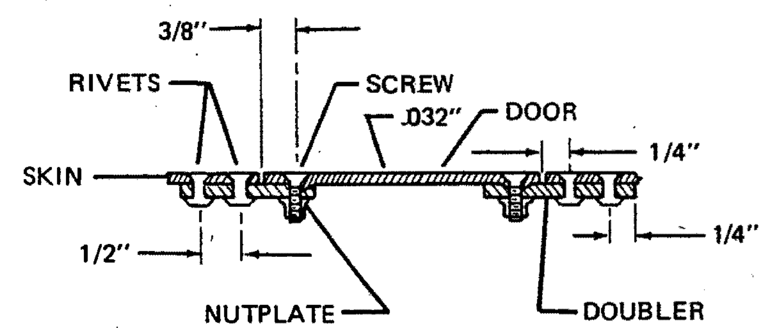
Repair of the wet wing tip is permissible providing the damaged area is far enough from the rib to allow a doubler or plate to be installed. Holes cut to remove damaged area must be round or at least have generous radii. Should a stringer be damaged or fall within the repair area it must be bridged across and be attached to the repair.

CAUTION

It must be realized the wet wing tip is a highly stressed area; consequently, the repair structure must be of equal capability.

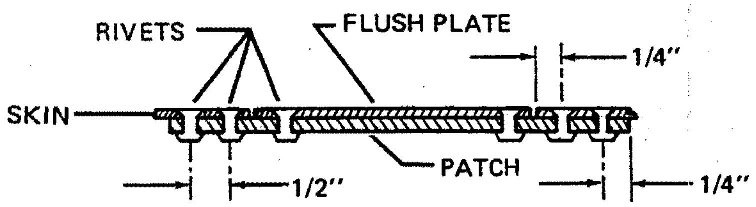
GENERAL INSTRUCTIONS

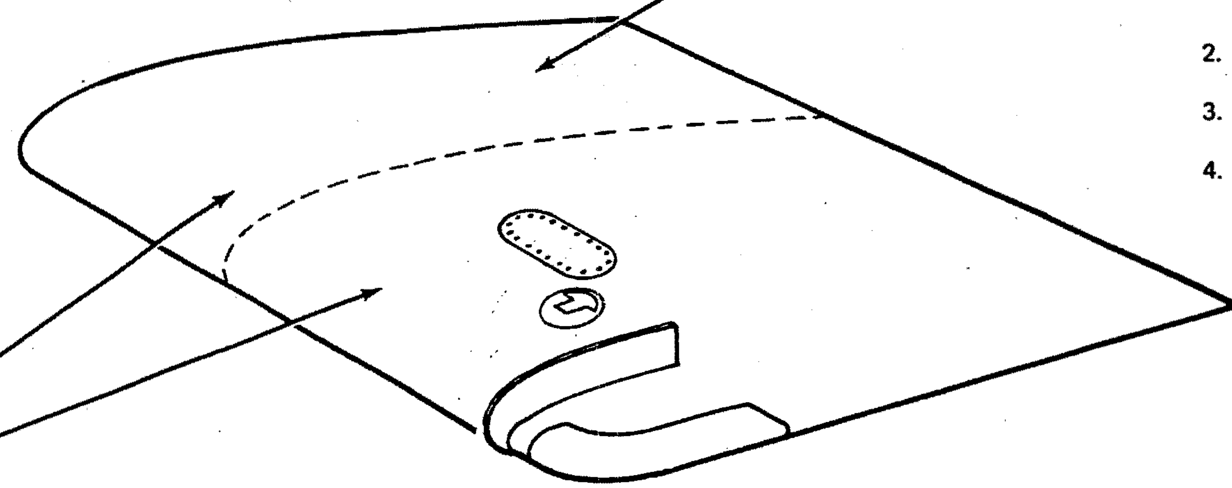
1. Seal edges of doubler or plate, rivet butts and nut plates with PR890B-1/2 (19, Chart 205, 91-00-00) or EC 1675B-1/2 (20, Chart 205, 91-00-00).
2. Fill the rivet heads, screw heads and the patch/skin joints with PR890B-1/2 (19, Chart 205, 91-00-00) or EC 1675B-1/2 (20, Chart 205, 91-00-00).
3. Pressure test (0.50 + 0.25 - 0.00 psig) before applying filler to outer surface.



REPAIR OF INACCESSIBLE AREAS

1. Door material - .032 2024 T3 Aluminum ALCLAD.
   Doubler material - .051 2024 T3 Aluminum ALCLAD.
   Nut Plates - K1000-832 or equivalent.
   Screws - AN507-8R–length to be determined.
   Rivets - AN426AD3–for attaching nut plates.
   Rivets - AN426AD4–for attaching doubler.
2. Two rows rivets in doubler and skin--1/4" E.D., 1/2" spacing between rows and rivets.
3. Single row of screws through doubler and door–3/8" E.D., 5/8" spacing. Dimple door and countersink doubler.
4. Doubler may be cut on one side only in order to place it on inside of cell. Cut side of doubler to be placed on inboard or outboard side of repair.





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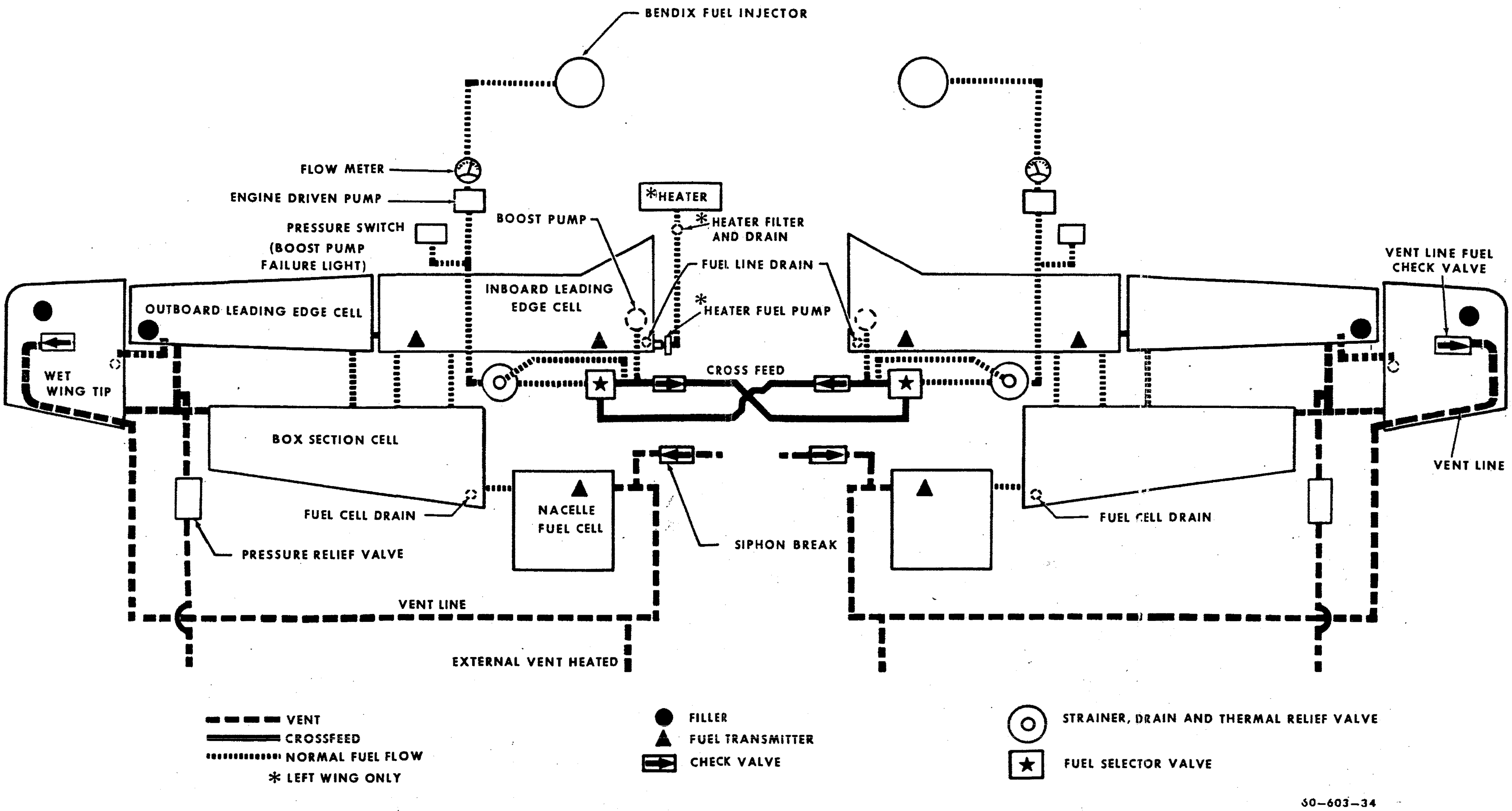
REPAIR OF ACCESSIBLE AREAS

1. Rivets - AN426AD4-5
   Patch material - .032 2024 T3 Aluminum ALCLAD
   Plate material - .032 2024 T3 Aluminum ALCLAD
2. Two rows rivets through patch and skin (patch plate to be on inner surface of cell. --If the plate is too large for entry through access openings, use method for inaccessible area.)
3. Rivet E.D. 1/4"–spacing 1/2" between rows and rivets.
4. Fit flush plate and secure with only enough rivets to prevent filler from cracking.

Minor Wet Wing Tip Repair
Figure 206



Optional Fuel System Schematic
(P-348, P-365 and after)
Figure 2

"END"

GENERAL - DESCRIPTION AND OPERATION (Figure 1)

FUEL CELLS

The fuel system installation consists of an inboard main fuel cell and an outboard cell in the leading edge, a nacelle tank, a wing panel fuel cell in each wing and a wet wing tip tank (optional on serials P-348, P-365 and after). All of the fuel cells in each wing and wing tip are interconnected in order to make all of the usable fuel in each wing available to its engine when the fuel selector valve is turned ON. The interconnecting fuel cells are serviced either through the single filler on each wing or the filler in each of the optional wet wing tips, providing single point filling for each side. The combined capacity of the standard and optional systems is shown below:

SERIALS	*CAPACITY IN GALLONS*	*USABLE IN GALLONS*
P-3 thru P-195 inboard leading edge fuel cells unbaffled	207	192
P-3 and after with inboard leading edge baffled fuel cells	207	202
Optional fuel system P-348, P-365 and after	237	232

FUEL CROSSFEED

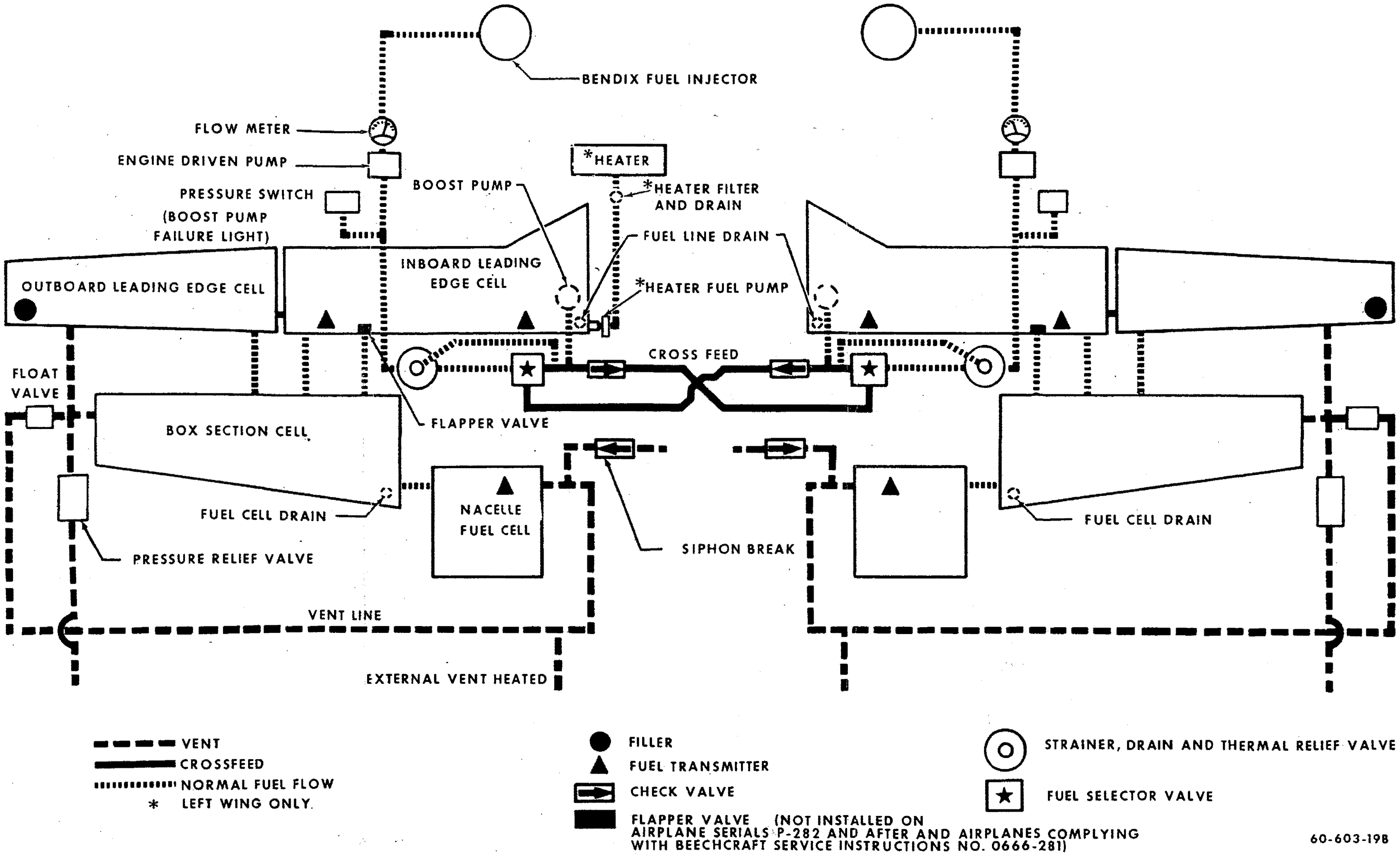
The separate identical fuel supplies for each engine are interconnected by crossfeed lines. During normal operation, each engine uses its own fuel pumps to draw fuel from its respective fuel tank arrangement. However, on crossfeed operations, the entire usable fuel supply of both wings can be consumed by either engine.

FUEL BOOST PUMPS

Submerged, tank-mounted fuel boost pumps are provided for each engine and are located in the inboard leading edge tanks. They are controlled by separate ON-OFF toggle switches located on the pilot's subpanel. The fuel boost pumps provide for near maximum engine performance should the engine-driven pump fail. Fuel boost pump failure is indicated by illumination of a FUEL PRESS light on the panel.

FUEL CELL DRAINS

The fuel system is drained by six snap-type drains under the wings. A drain is located in each inboard leading edge fuel cell, box section fuel cell and fuel strainer. An additional fuel strainer drain for the heater fuel line is located in the nose wheel well.



Fuel System Schematic
Figure 1

EXTENSION AND RETRACTION - MAINTENANCE PRACTICES

LUBRICATION

Lubricate the landing gear retract system as detailed in the Lubrication Chart in Chapter 12-20-00.

LANDING GEAR MOTOR AND ACTUATOR REMOVAL

When it is necessary to remove only the landing gear motor, accomplish steps "a", "b", "g" and "m".

a. Remove the cabin front seat.
b. Remove the carpet and access covers on top and directly behind the front carry through structure.

CAUTION

When removing the actuator from the airplane, do not remove the actuator drive shaft from the actuator. The drive shaft is indexed to the sector gear and the actuator will have to be disassembled to reinstall the drive shaft.

c. Disconnect the fuel selector valve controls and move them as far to one side as the cable slack will allow.
d. Disconnect the main landing gear retract rods at the actuator.
e. Disconnect the landing gear door retract rods at the actuator.
f. Remove the screws securing the landing gear limit switch assembly(ies) to the actuator and move the switch assembly(ies) aside to permit removal of the actuator.

NOTE

On serials P-139 and after, there are two switch assemblies, one on each side of the actuator.

g. Disconnect electrical wiring from the landing gear motor and the dynamic brake relay.
h. Remove the landing gear actuator access door on the bottom of the fuselage, and remove the nose gear actuator retract arm and linkage from the actuator.
i. Through the actuator access opening, remove the four nuts attaching the actuator to the fuselage structure.
j. Remove the landing gear actuator upper support retaining nut.
k. Remove the screws securing the upper support plate to its cross member.
l. Remove the landing gear actuator. The cross member may have to be moved upward to gain clearance as the actuator is lifted to clear its attaching studs.
m. Remove the three bolts attaching the landing gear motor to the actuator.

LANDING GEAR MOTOR AND ACTUATOR INSTALLATION

If only the landing gear motor has been removed, accomplish steps "a", "g", "j" and "k".

a. Install the three bolts attaching the landing gear motor to the actuator and secure with safety wire.
b. Position the actuator against the fuselage structure and install the four attaching bolts.

NOTE

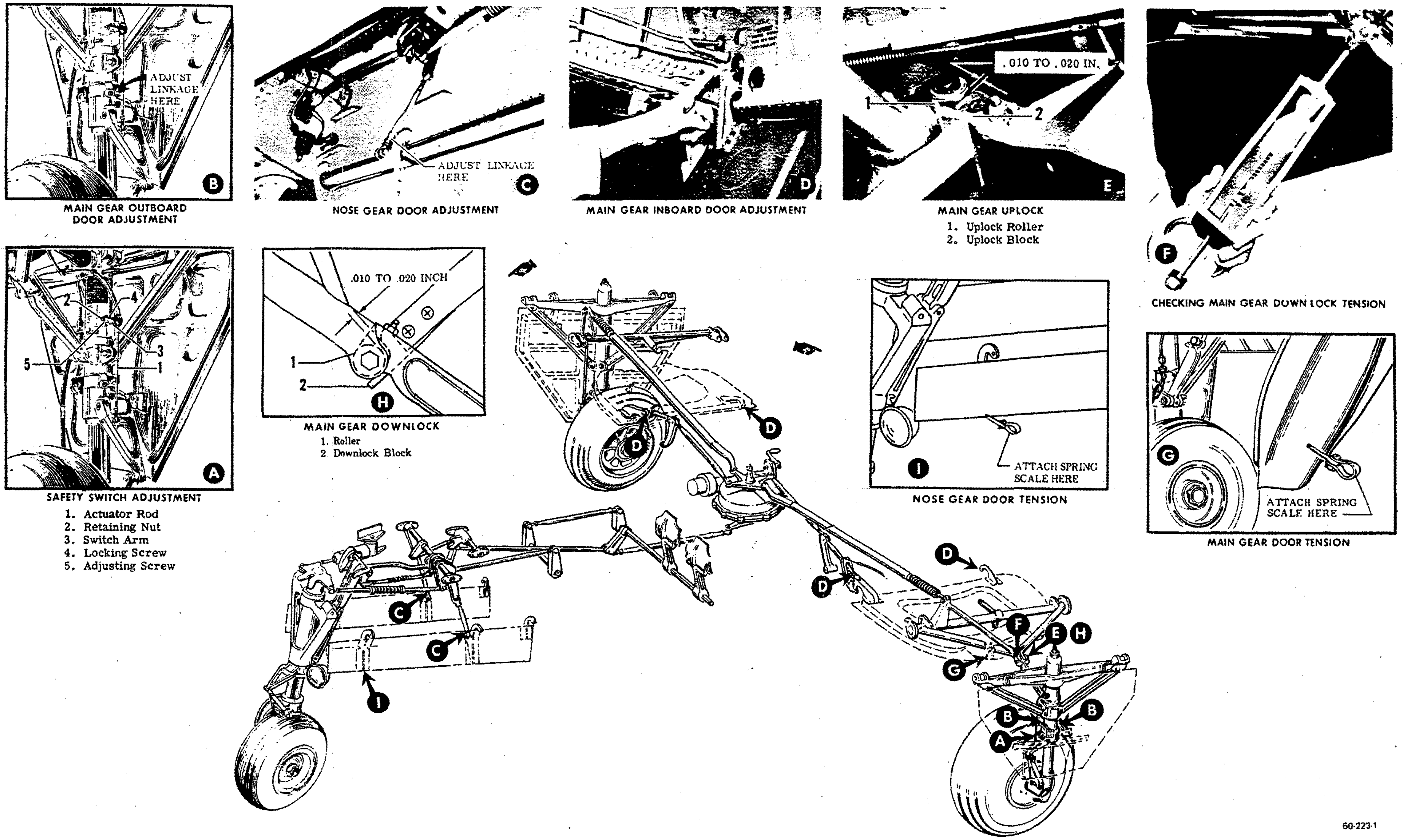
Prior to installing the actuator nuts, apply thread locking compound (36, Chart 207, 91-00-00) to the actuator stud threads.

c. Install the upper support plate to the cross member.
d. Install the actuator upper support retaining nut.
e. Secure the landing gear limit switch assembly(ies) to the actuator.
f. Connect the main landing gear retract rods and door retract rods to the actuator. An AN960-616 washer is installed between the main gear retract rods and the actuator arm.
g. Connect the electrical wiring to the landing gear motor and the dynamic brake relay.
h. Connect the fuel selector valve control and check rigging. (Refer to Chapter 28-20-00).
i. Connect the nose landing gear rod and linkage to the actuator.

NOTE

When connecting the nose gear retract rod to the actuator, make certain the index mark on the arm and the actuator shaft coincide.

Check rigging of the landing gear system. When



Landing Gear System
Figure 201

ELEVATOR AND TAB - MAINTENANCE PRACTICES

ELEVATOR REMOVAL

a. Remove the tail cone and the access plate on the side of the fuselage beneath the RH horizontal stabilizer.
b. Loosen the elevator trim tab cables.
c. Disconnect the trim tab cables from the trim tab actuator chain by removing the master link at each end of the chain.
d. Disconnect the elevator push rods from the elevator torque tube fittings.
e. Remove the bolt from the inboard end of the elevator torque tube.
f. Remove the hinge bolts. Disconnect the elevator bonding cables and remove the elevator.

ELEVATOR INSTALLATION

a. Connect the elevator bonding cables. Position the elevator on the stabilizer and install the hinge bolts, washers and nuts. Tighten and safety.
b. Install the bolt in the inboard end of the elevator torque tubes. Torque the attaching bolts to 50-70 inch pounds.
c. Attach the elevator push rods to the elevator torque tube fittings. Torque the attaching bolts to 20-25 inch-pounds.
d. Position the elevator trim tab cables on the ends of the trim tab actuator chain and install the master links.
e. Adjust the tension on the elevator trim tab cables as noted on the Elevator Rigging Illustration, Figure 201.

NOTE

Check the trim tab system for correct movement of the control surface with respect to the movement of the trim tab control. When the elevator tab control is moved toward the NOSE DOWN position, the tab should move UP.

f. Connect the tail light wires and install the tail cone. Install the access plate on the side of the fuselage beneath the RH horizontal stabilizer.

ELEVATOR CABLE REMOVAL
(Figure 201)

a. Remove the tail cone and the access plate on the side of the fuselage beneath the RH horizontal stabilizer.
b. Remove the pilot's and copilot's seat and the floorboards in the pilot's compartment.
c. Remove the forward passenger seats and the floorboards between main and rear spar.
d. Remove the access panel in the floorboard aft of the rear spar.
e. Remove the cable retaining pins from the pulley brackets and the pressure seals from the rear pressure bulkhead.
f. Disconnect the elevator cables, in the aft fuselage, at the turnbuckles and connect lead lines to the forward cables.
g. Disconnect the cables at the forward bell crank. Identify both forward cables in relation to their attaching point on the bell crank. Remove the cables.
h. Disconnect the cables at the aft bell crank. Identify both aft cables in relation to their attaching point on the bell crank arms. Remove the cables.

ELEVATOR CABLE INSTALLATION
(Figure 201)

a. Route the aft elevator cables forward and connect to the applicable bell crank arms as noted during cable removal.
b. Route the forward elevator cables aft and connect to the bell crank as noted during cable removal.
c. Install all cable retaining pins in all pulley brackets.
d. Using PD680 solvent (15, Chart 207, 91-00-00), clean the cables for the length of travel through the pressure seals. Lubricate to one inch beyond the cleaned area with MIL-G-23827 grease (11, Chart 207, 91-00-00).
e. Fill the pressure seals with MIL-G-23827 grease (11, Chart 207, 91-00-00). Install the seals.
f. Connect the cables to the turnbuckles in the aft fuselage and rig the cable system.
g. Install the aft floorboard access panel, the floorboards between the main and aft spar, and the forward seats.
h. Install the floorboards in the pilot's compartment, and the pilot's and copilot's seats.
i. Install the tail cone and the access plate beneath the RH horizontal stabilizer.

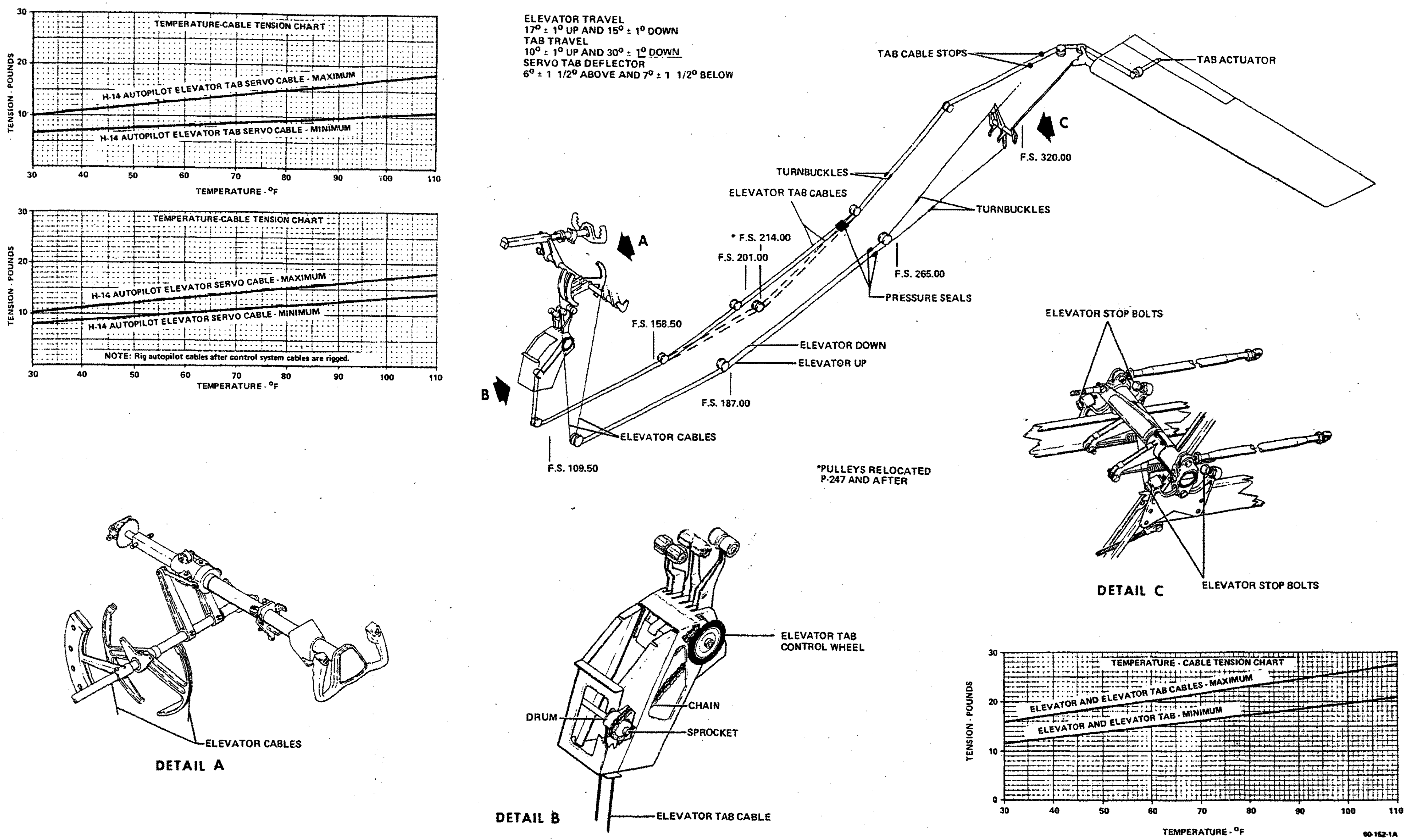
ELEVATOR CONTROL SYSTEM RIGGING
(Figure 201)

WARNING

When replacing or installing control cables, bell cranks and other control system components, observe the color coding on all parts. DO NOT connect coded parts of one color to coded parts of a different color.

NOTE

BEECHCRAFT recommends the use of the elevator travel gage shown in SPECIAL TOOLS in Chapter 12-20-00.



Rigging the Elevator Control System
Figure 201

RUDDER AND TAB - MAINTENANCE PRACTICES

RUDDER REMOVAL

a. Remove the tail cone and the access plate on the side of the fuselage beneath the RH horizontal stabilizer.

b. Detach the tail cone, disconnect the tail navigation light wire, and remove the tail cone.

c. Disconnect the rudder tab cables at the turnbuckles. Remove the tab cable retainer pins and fairlead.

d. Remove the four bolts securing the rudder torque tube and tab pulley bracket to the rudder bell crank.

e. Remove the upper and lower hinge bolts and remove the rudder.

RUDDER INSTALLATION

a. Align the holes in the rudder and stabilizer hinges and install the attaching bolts.

b. Secure the tab pulley bracket and rudder torque tube to the rudder bell crank with the four attaching bolts. Torque the bolts to 50-70 inch-pounds.

c. Connect the rudder tab cables at the turnbuckles and install the cable retainer pins and fairlead.

d. Check the travel of the tab and the rudder tab indicator to ensure that the tab and indicator agree.

e. Connect the tail light wires and install the tail cone. Reinstall the access plate beneath the RH horizontal stabilizer.

RUDDER CABLE REMOVAL
(Figure 201)

a. Remove the tail cone and the access plate on the side of the fuselage beneath the RH horizontal stabilizer.

b. Remove the pilot's and copilot's seat and the floorboards in the pilot's compartment.

c. Remove the forward passenger seats and the floorboards between the main and rear spar.

d. Remove the access panel in the floorboard aft of the rear spar.

e. Remove the cable retaining pins from the pulley brackets and the pressure seals from the rear pressure bulkhead.

f. Disconnect the rudder cables, in the aft fuselage, at the turnbuckles and connect lead lines to the forward cables.

g. Disconnect the forward cables at the bell crank and remove the cables through the pilot's compartment.

h. Disconnect the aft cables at the rudder bell crank and remove the cables.

RUDDER CABLE INSTALLATION

a. Route the aft rudder cables forward in the tail section and connect to the rudder bell crank.

b. Route the forward rudder cables aft from the pilot's compartment and connect the cables to the bell crank.

c. Install all cable retaining pins in the pulley brackets.

d. Using PD680 solvent (15, Chart 207, 91-00-00), clean the cables for the length of travel through the pressure seals. Lubricate to one inch beyond the cleaned area with MIL-G-23827 grease (11, Chart 207, 91-00-00).

e. Fill the pressure seals with MIL-G-23827 grease (11, Chart 207, 91-00-00). Install the seals.

f. Connect the cables to the turnbuckles in the aft fuselage and rig the cable system.

g. Install the aft floorboard access panel, the floorboards between the main and aft spar, and the forward seats.

h. Install the floorboards in the pilot's compartment, and the pilot's and copilot's seat.

i. Install the tail cone and the access plate beneath the RH horizontal stabilizer.

RUDDER CONTROL SYSTEM RIGGING
(Figure 201)

a. Remove the tail cone, the access plate on the side of the fuselage beneath the RH horizontal stabilizer, and the access panel in the aft floorboard.

b. Release the rudder pedal adjusting levers and place all pedals in the aft position.

c. Insert a 7/16-inch diameter rig pin through the upper arm of the pilot's rudder pedals to rig neutral on the rudder pedals. This will also bring the copilot's rudder pedals to the same adjustment as the pilot's pedals.

d. Place the rudder and rudder bell crank in the neutral position.

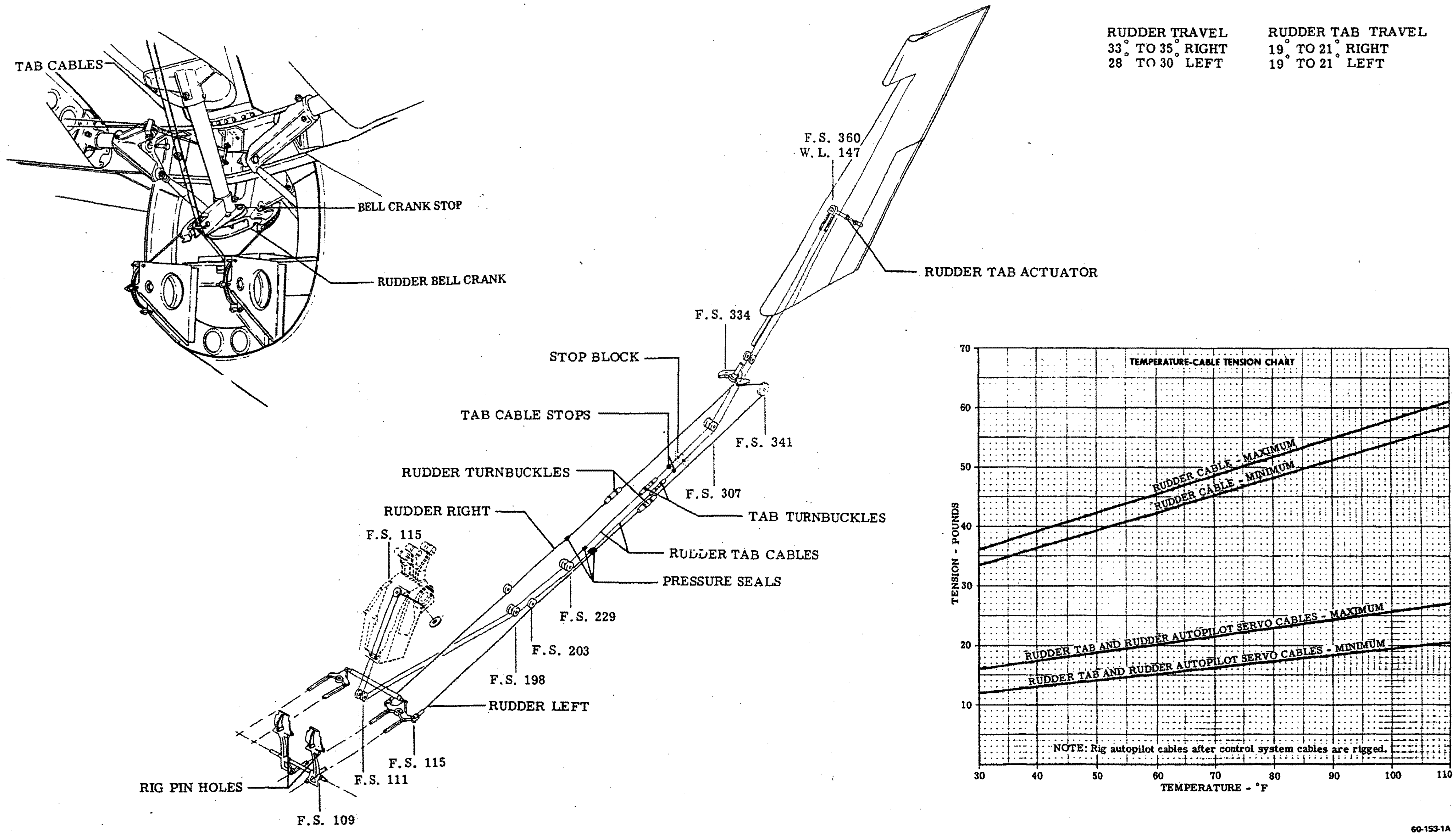
e. Rig the rudder cables to the proper tension as determined by reference to the Temperature-Cable Tension Chart. Safety wire the turnbuckles.

f. Remove the rig pin from the rudder pedals and adjust the stops for the rudder bell crank until the rudder has a travel of 33 to 35 degrees right and 28 to 30 degrees left from the centerline of the horizontal stabilizer in response to the corresponding movement of the rudder pedals.

NOTE

With the rudder and steering system fully installed, properly rigged, and the nose wheel extended and off the ground, the force required for full right rudder deflection should not exceed 25 pounds as measured at the pivot point of each rudder pedal. The force required for full left rudder deflection, measured at the rudder pedal pivot point, should not exceed 23 pounds.

g. Install the tail cone, the access plate beneath the



Rigging the Rudder Control System
Figure 201

AILERON AND TAB - MAINTENANCE PRACTICES

AILERON REMOVAL

a. Disconnect the aileron tab push rod.

b. Support the aileron and remove the two attaching screws from the top and bottom of each hinge bracket.

c. Pull the aileron straight away from the wing to avoid damage to the attaching areas.

d. Remove the screws attaching the bonding cables to the aileron.

AILERON INSTALLATION

a. Attach the bonding cables to the aileron.

b. Place the aileron in position on the hinge brackets. Be sure the hinge bracket is in the proper place between the aileron skin and the reinforcing structure.

c. Install the upper and lower hinge bracket screws.

d. Connect the aileron tab push rod.

AILERON CONTROL CABLE REMOVAL
(Figure 201)

a. Remove the pilot's and copilot's seat, and the floorboards in the pilot's compartment.

b. Remove the forward passenger seats and the floorboards between the main and rear spar.

c. Remove the access plates, as necessary to gain access to the aileron cables and pulley brackets, on the lower trailing edge of the wings.

d. Remove all necessary cable retaining pins from the cable pulley brackets. Remove the pressure seals on each side of the fuselage.

e. Disconnect the forward aileron cables from the chain and cable assembly at the turnbuckles at the control column. Install lead lines to both aileron cables.

f. Paint one tooth of the control column sprocket and the corresponding link of the chain and cable assembly to insure proper alignment at installation.

g. Disconnect the forward aileron cables and the forward outboard wing cable at the turnbuckles in each wing. Identify and remove both forward cables.

h. Disconnect the balance cable at the turnbuckle in each wing. Connect a lead line to one end of the cable and remove the cable.

i. Disconnect the forward outboard, and the aft outboard cables at the bell crank in each wing. Identify and remove the cables.

AILERON CONTROL CABLE INSTALLATION

a. Connect the forward outboard, and the aft outboard cables to the bell crank in each wing. Route the cables inboard.

b. Route the balance cable through one wing, the fuselage, then through the opposite wing. Connect the balance cable and the aft outboard cables to the turnbuckles in each wing.

c. Route one end of the aileron cables outboard in each wing, and the other end forward to the control column. Connect the cables to the turnbuckles at the forward outboard cable in each wing.

d. Position the chain and cable assembly on the control column sprocket. Ensure that painted link and the corresponding painted tooth are aligned.

e. Connect the chain and cable assembly to both aileron cables at the turnbuckles at the control column.

f. Install all retaining pins in the pulley brackets.

g. Using PD680 solvent (15, Chart 207, 91-00-00), clean the cables for the length of travel through the pressure seals. Lubricate to one inch beyond the cleaned area with MIL-G-23827 grease (11, Chart 207, 91-00-00).

h. Fill the pressure seals with MIL-G-23827 grease (11, Chart 207, 91-00-00). Install the seals.

i. Rig the aileron control system.

j. Install the access plates on the lower trailing edge of the wings.

k. Install the floorboards and the forward passenger seats.

l. Install the floorboards and the pilot's and copilot's seats.

AILERON CONTROL SYSTEM RIGGING
(Figure 201)

a. The contour of the aileron must align with the contour of the wing within 1/16 inch (.0625 inch) on either or both sides.

b. Aileron and connecting linkage may have a maximum of 1/16 inch lost motion. Check for lost motion at the midpoint of the aileron trailing edge with the bell crank stationary.

c. The aileron is in neutral when its outboard trailing edge aligns with the trailing edge of the wing tip and its inboard end is parallel with the outboard end of the flap. A horizontal misalignment of plus or minus 3/16 inch is allowed between trailing edges of the aileron and wing tip. With the bell crank parallel to the wing rib, set the aileron in neutral by adjusting the length of the push-pull tube. Loosen the locknuts on both ends and turn the tube to shorten or lengthen.

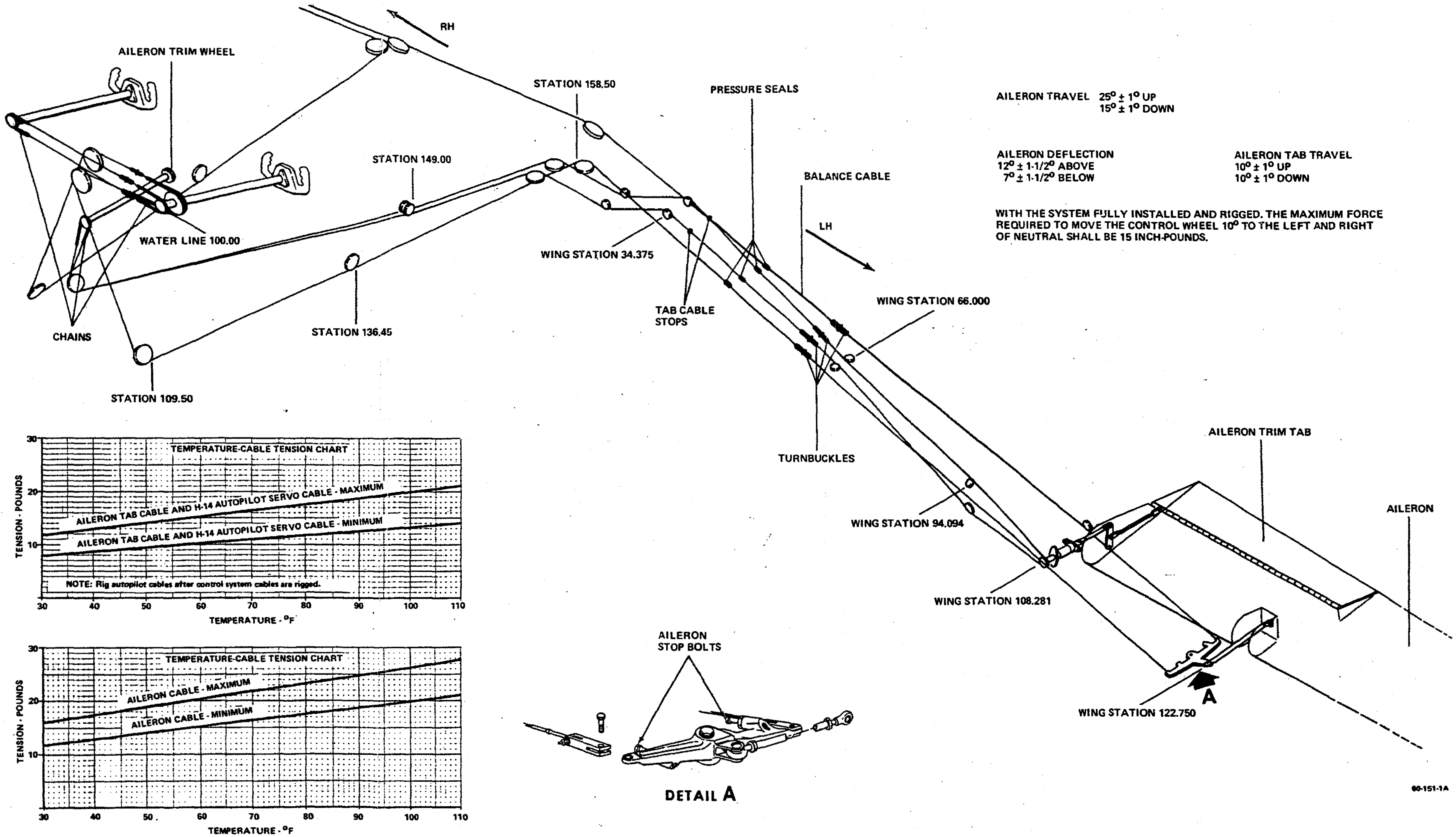
d. Securely tighten the locknuts on all rod ends. Rig cable tension and adjust travel as noted on Aileron Rigging Illustration.

e. With the aileron system fully rigged, the maximum force required to move the control wheel 10 degrees to the left and right of neutral should not exceed 15 inch-pounds.

AILERON TRIM TAB CABLE REMOVAL
(Figure 201)

a. Remove the pilot's seat and the left floorboard.

b. Remove the lower forward upholstery panel on the

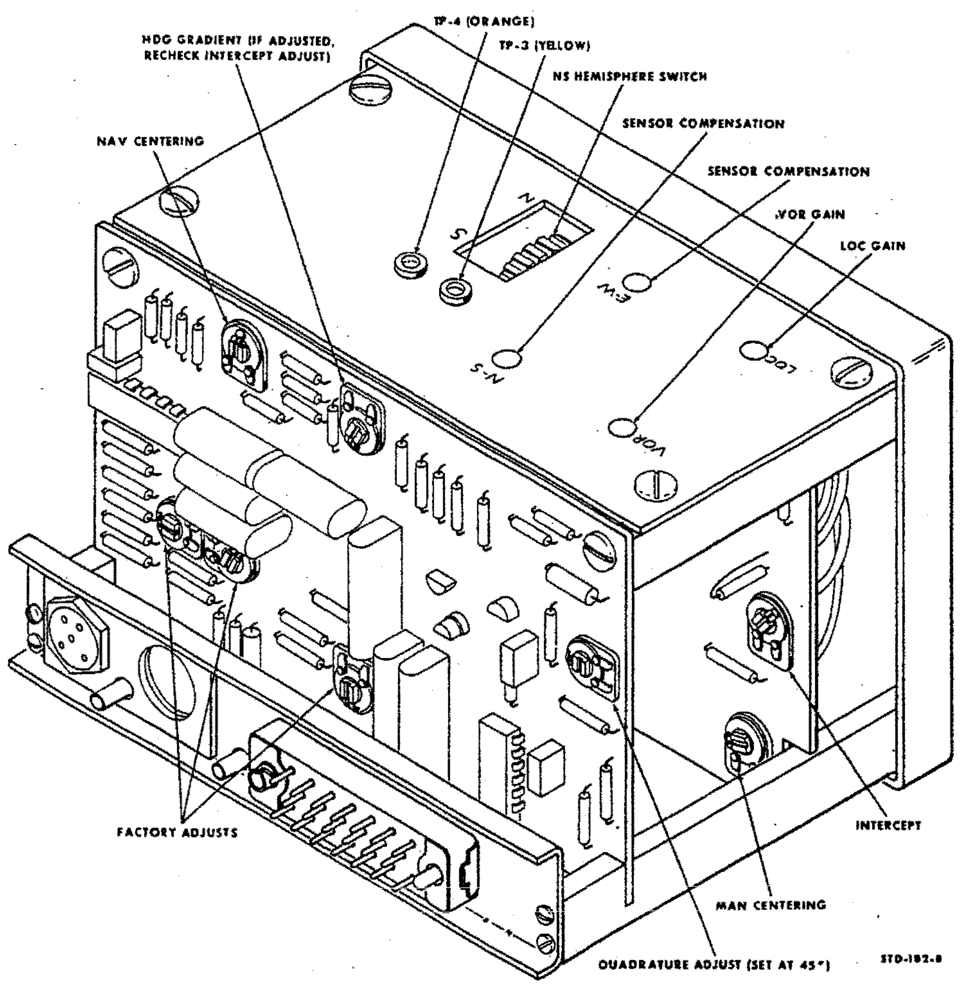


Rigging the Aileron Control System
Figure 201

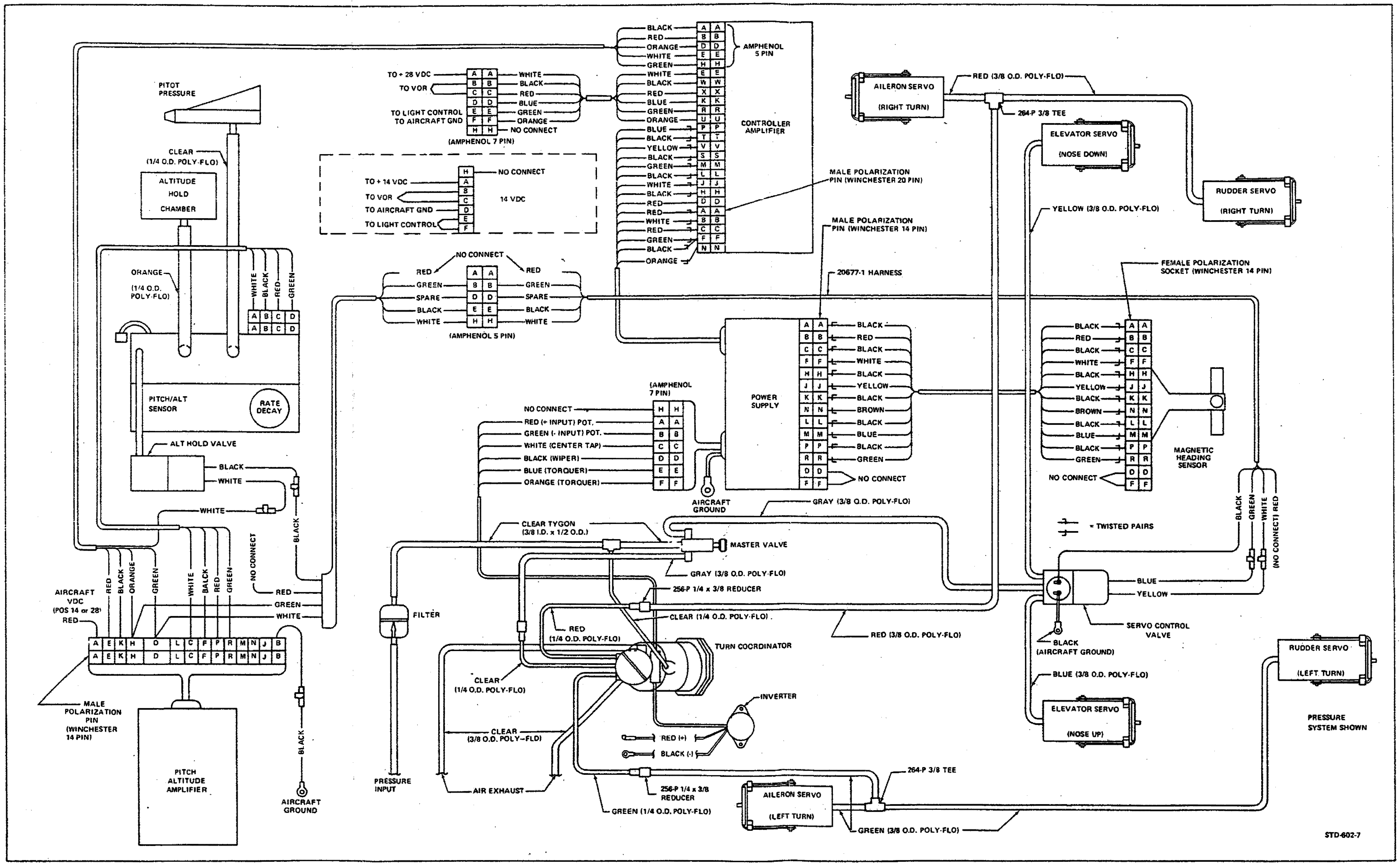
GENERAL - DESCRIPTION AND OPERATION

NEW-MATIC AUTOPILOT

The BEECHCRAFT New-matic autopilots operate on an electro-pneumatic concept. Electronic circuitry is used for navigational beam detections, magnetic heading direction, and turns. Pneumatic servos are used for the flight control actuators. The systems are completely non-tumbling. Yaw, roll and turn detection is made by a tilted gyro EVT turn coordinator (electrical vacuum torquing combination) mounted in the instrument panel. A dampened miniature aircraft serves as the instrument indicating arm. Any deviation from straight flight causes the rate gyro to move a pressure (or vacuum) valve which puts force into the aileron or rudder to return the aircraft to straight flight. Turns or beam following is made by rotating a valve sleeve by a torquing movement proportional to the voltage imposed upon it. This unit also supplies an output voltage proportional to the turning rate that is used for dip compensation and nose up signal during turns. The pitch control system does not use a gyro for reference, but uses the airspeed, rate of airspeed change and inertial signals to control the elevator through the pitch servos. An altitude hold sensing unit works in conjunction with the pitch control to sustain a given altitude.



Heading Loc/Navigation Coupler System Adjustments
Figure 1



New-matic Autopilot Block Diagram
Figure 2

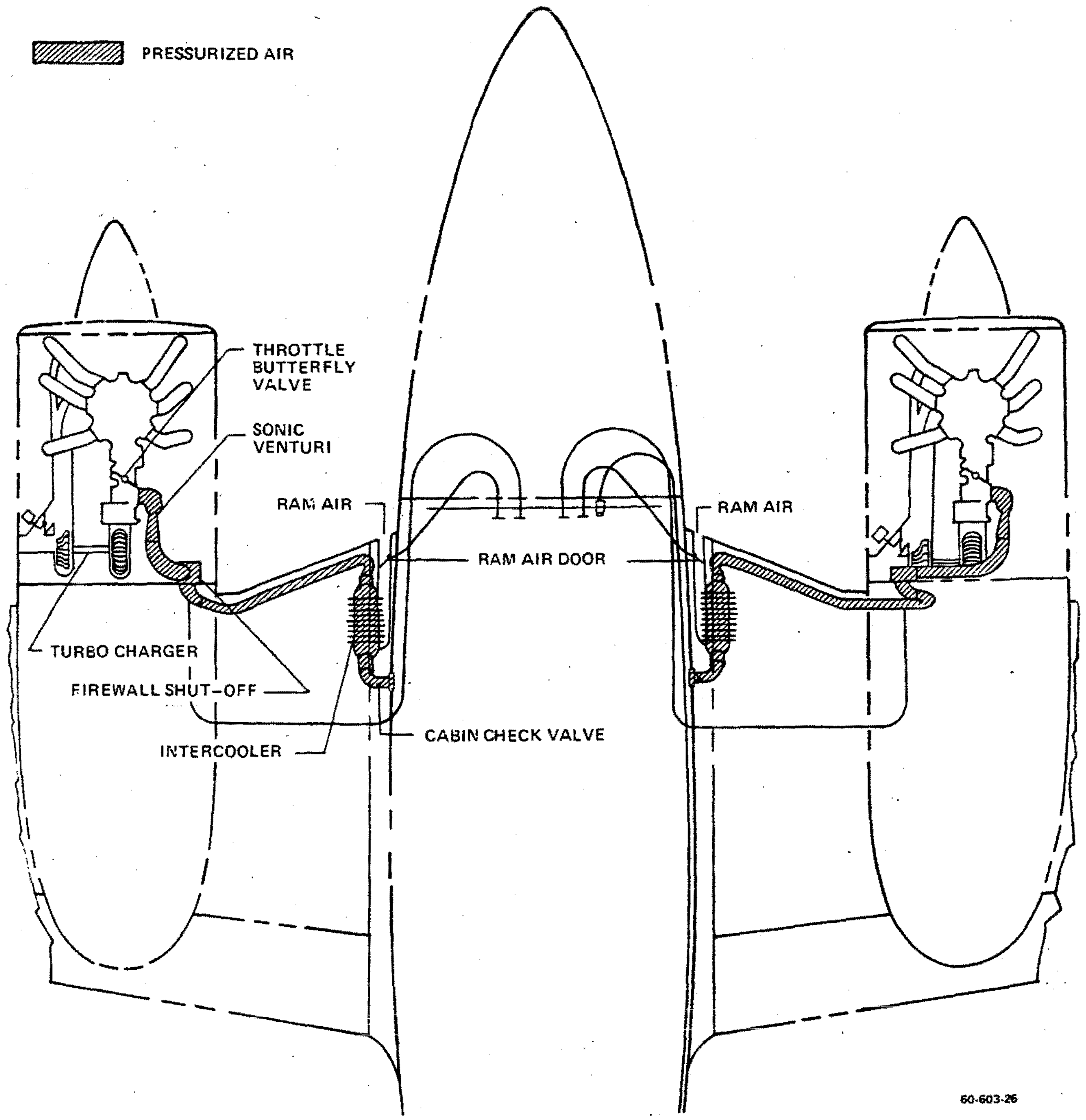
"END"

DISTRIBUTION - MAINTENANCE PRACTICES

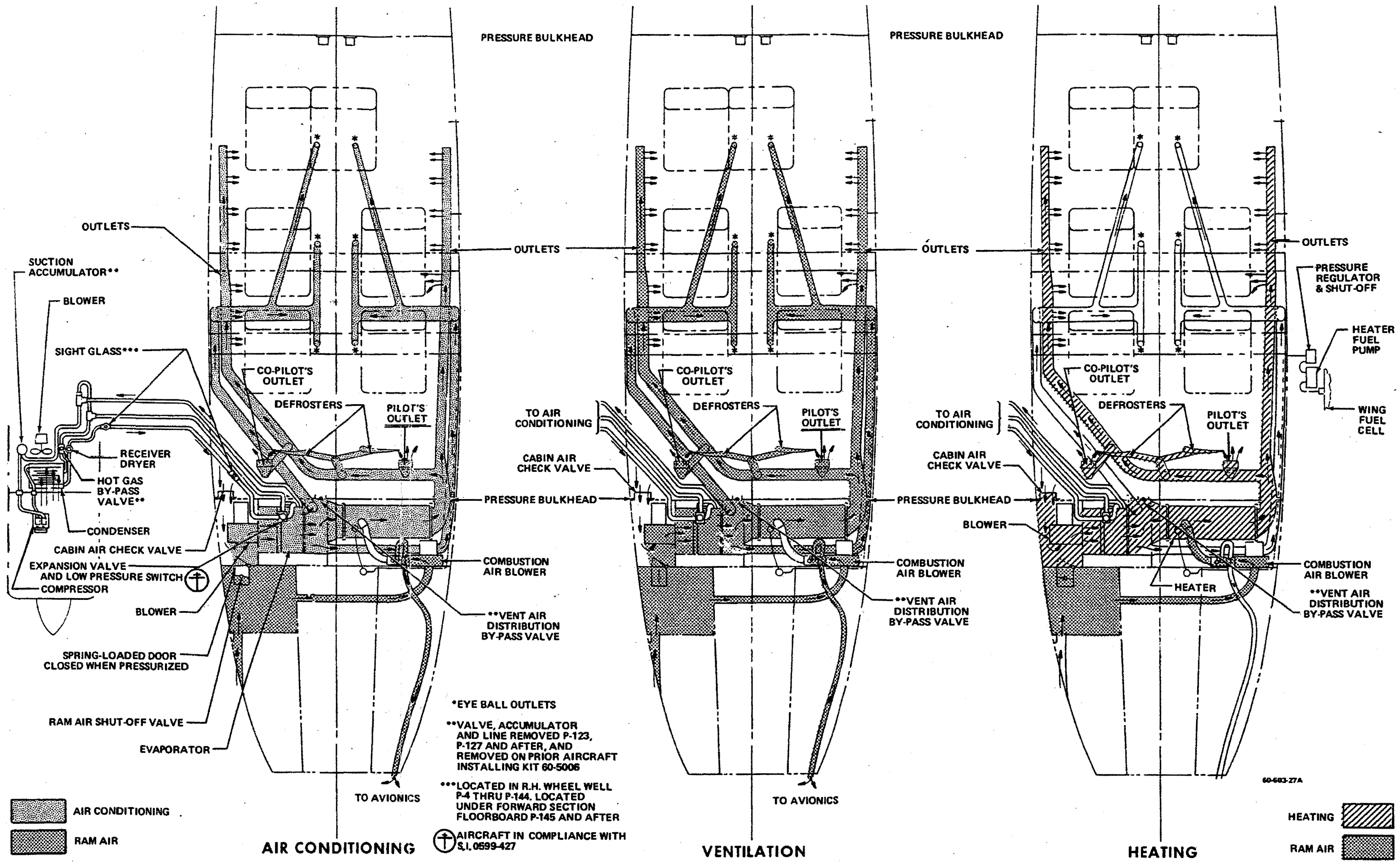
The functional diagrams on the following pages provide a detailed layout of the distribution system utilized by the various series of the Duke.

100-HOUR INSPECTION

Distribution Ducts - Check cabin hot and cold air outlet valves for condition, obstructions and proper operation; check heating and cooling ducts for condition and attachment.



Pressurization Distribution System
Figure 201

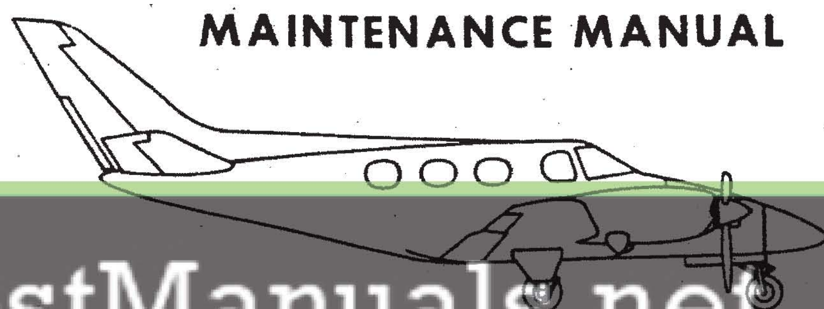


Air Conditioning Distribution System (P-3 thru P-246)
Figure 202

Beechcraft® DUKE

MODEL 60 (P-4 thru P-126 except P-123)
MODEL A60 (P-123, P-127 thru P-246)
MODEL B60 (P-247 and after)

MAINTENANCE MANUAL



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